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J. A. MALLETT

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Issued by direction of THE MINISTER FOR AGRICULTURE.

COVER PICTURE

These intensive laying pens at the Poultry Research Station, Herdsman Lake, are used to house birds entered in the Random Sample Egg-Laying Test.

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Cobalt Deficiency in Sheep and Cattle

Treatment Using Cobalt "Bullets"

By A. W. WILLIAMS, B.V.Sc.,
Veterinary Surgeon

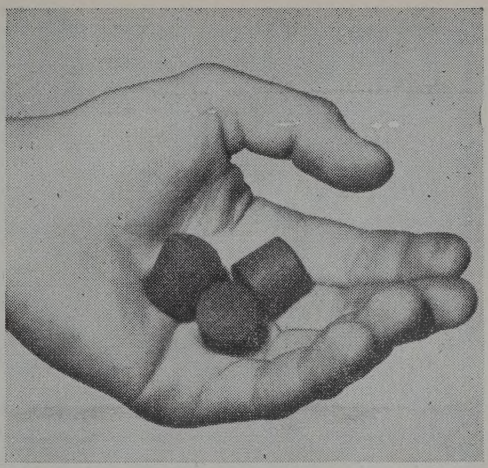

Fig. 1.—The cobalt bullets as used for cattle

THE problem of supplying cobalt supplements to sheep and cattle running on cobalt-deficient country has been greatly simplified by the cobalt "bullets" or pellets recently developed by officers of the C.S.I.R.O. The "bullets" consist of cobalt oxide combined with a special clay mixture by firing at a high temperature, and when lodged in the animals' digestive system they gradually release the small quantities of cobalt required to maintain good health.

Although it is only required in minute quantities, cobalt is a vitally essential element in the diet of ruminants such as sheep and cattle.

It is necessary to ensure the production of vitamin B_{12} by the bacteria inhabiting the rumen or paunch. This vitamin is essential for normal growth and main-

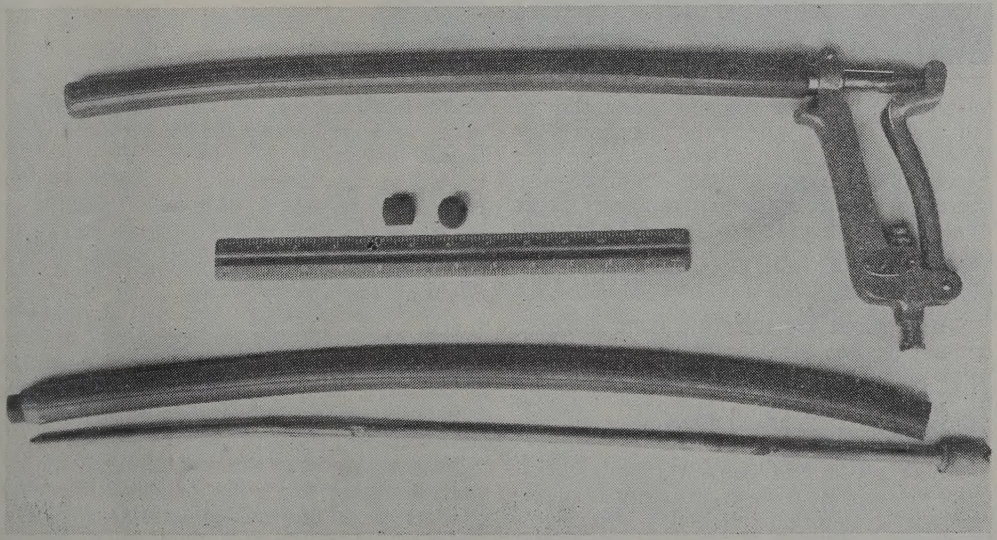

Fig. 2.—The Bainbridge cattle cobalt bullet gun, and a home-made pellet gun consisting of a length of ¾ in. hose and a plunger

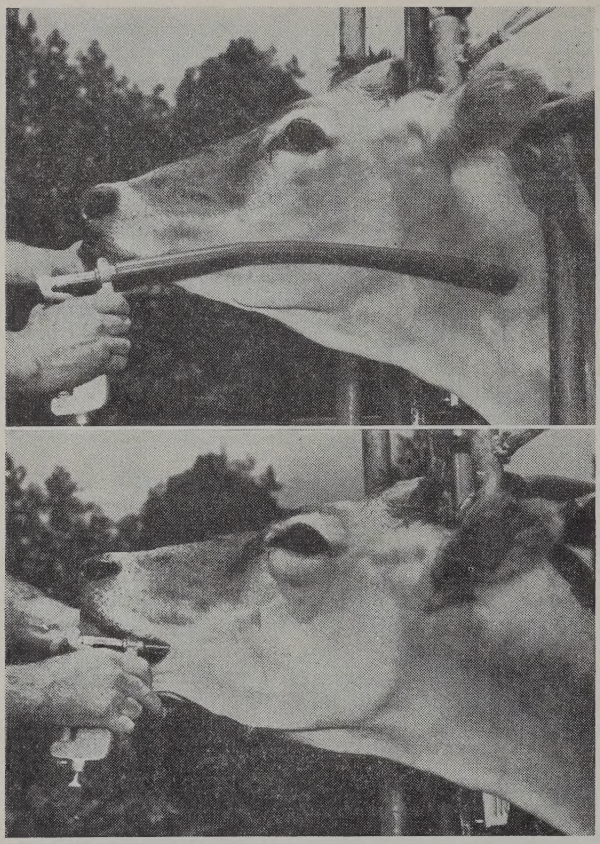

Fig. 3.—The Bainbridge gun in use. The distance which the tube enters the gullet may be gauged by the top photograph.

tenance of life and for the production of red blood cells. Where the necessary intake of cobalt is not provided by the vegetation grazed by the animals—and there are extensive cobalt-deficient areas in several Australian States—some form of cobalt supplement must be given. The cobalt bullet provides a continuous well-regulated supply.

Where stock are suffering from a cobalt deficiency they lose condition and become weak and anaemic. Wool growth is affected in the case of sheep, and the animals literally starve to death although feed may be abundant.

Young stock and lactating females require vitamin B_{12} to be continually available and are therefore particularly susceptible to cobalt deficiency. Due to the non-development of the rumen in young animals, however, lambs and calves under eight weeks of age should not be dosed with cobalt bullets.

The cobalt bullets are administered by means of specially designed "guns" as shown in the illustrations. These place the bullet in the animal's gullet where it can be swallowed quickly.

Due to its density, the bullet usually enters the reticulum (also known as the "second stomach" or "honeycomb") where it remains. In a small proportion of cases, the bullets are regurgitated and the animal will require to be dosed again.

Where these instruments are not available, a satisfactory substitute can be easily made from a length of plastic hose with a piece of cane or similar flexible material to serve as a plunger to eject the pellet.

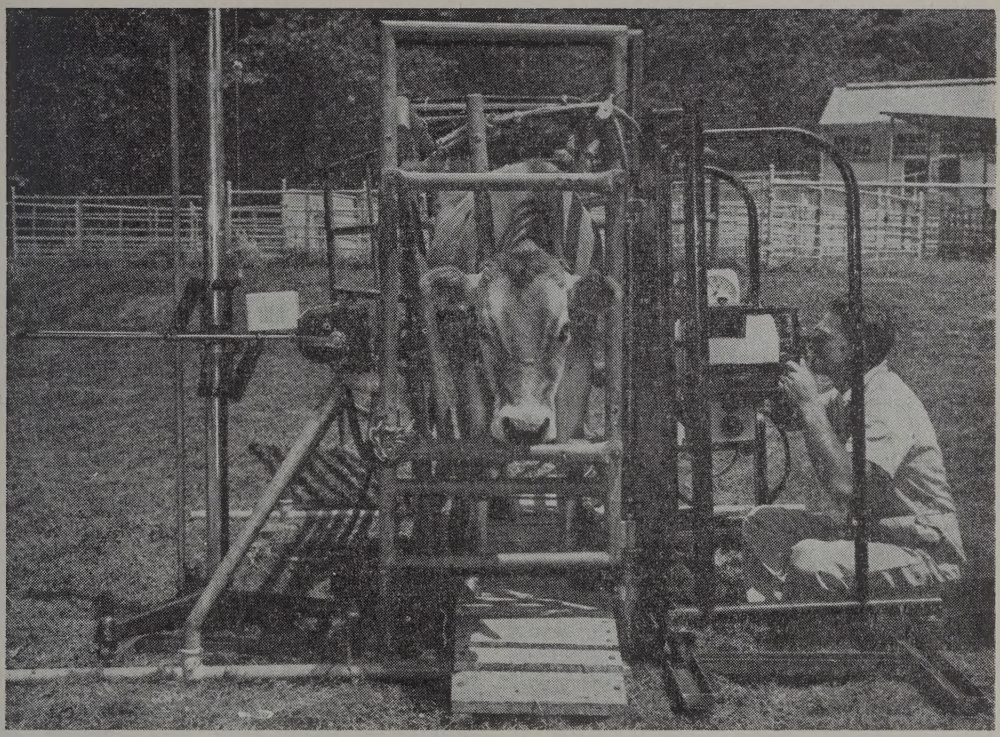

Fig. 4.—A Jersey heifer being examined by an X-ray fluoroscope to check on the period that the cobalt bullet is retained

CATTLE

The bullets used for cattle are four times the weight of those used for sheep. Sheep bullets should not be used for cattle as research has shown that they are not retained long enough for the treatment to be reliable.

Dosing is best carried out in a crush with a bail gate at the end—especially in the case of beef cattle. Dairy cattle can usually be dosed satisfactorily in the milking bails whether they be of the yoke or walk-through type.

The special Bainbridge cattle cobalt bullet gun (illustrated) may be used, or alternatively a simple home-made gun can be constructed from a 2 ft. length of $\frac{3}{4}$ in. (internal diameter) plastic hose with a suitable piece of cane or other plastic material sliding inside it to eject the pellet. The hose should have the end rounded to avoid injury to the membranes of the gullet and the cane plunger should be fitted with a suitable stop to ensure that it does not project beyond the end of the hose when the pellet is ejected.

The conventional balling gun as commonly used for administering physic balls to horses, could also be used to dose cows with cobalt bullets, but as this only places the pellet at the back of the tongue, the animals should be observed for a few minutes to ensure that the pellets are swallowed.

Do not dose calves until they are at least two months old, but dose both beef and dairy stock as soon as convenient after this age.

Milking cows are best dosed twice yearly —at drying-off and three months after calving. It is recommended that first-calf heifers should be dosed about three months before calving and thereafter as recommended for cows.

The symptoms of cobalt deficiency in cattle are much less obvious than is the case with sheep. Where there is unthriftiness, harsh, staring coat, falling-off in con-

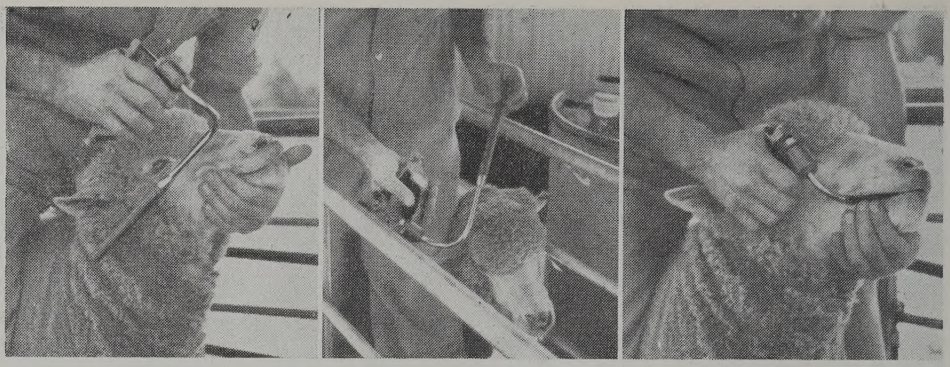

Fig. 5.—One type of bullet gun for sheep, showing the instrument; inserting the pellet in the tube, and administering the bullet

dition, lack of appetite, anaemia and lowered production, the possibility of cobalt deficiency should be considered, together with other possible causes such as worm infestation.

Under such circumstances, stock-owners could test for cobalt deficiency by dosing half the herd and comparing the progress of the supplemented and unsupplemented animals over the next few months.

SHEEP

For many years it has been known that sheep could never be successfully depastured for long periods on certain areas in many countries of the world.

Despite the fact that these areas often carried pasture growth which appeared to be adequate in both quantity and quality, sheep running on such country rapidly declined in condition and died if not moved on to other pastures. Various names such as "pining," "bush sickness," "salt sick," "coast disease" and other terms were coined to describe this mysterious illness and it is only within the last few decades that the ailment was shown to be due to lack of cobalt and/or copper in the vegetation of these districts. Special licks and drenches or the supplementing of the water supplies to make good these deficiencies helped in overcoming the problem, but the development of the cobalt bullet marks an important advancement in supplementary feeding.

To be effective, the cobalt supplement must be available continually and it was found that not all animals consumed the

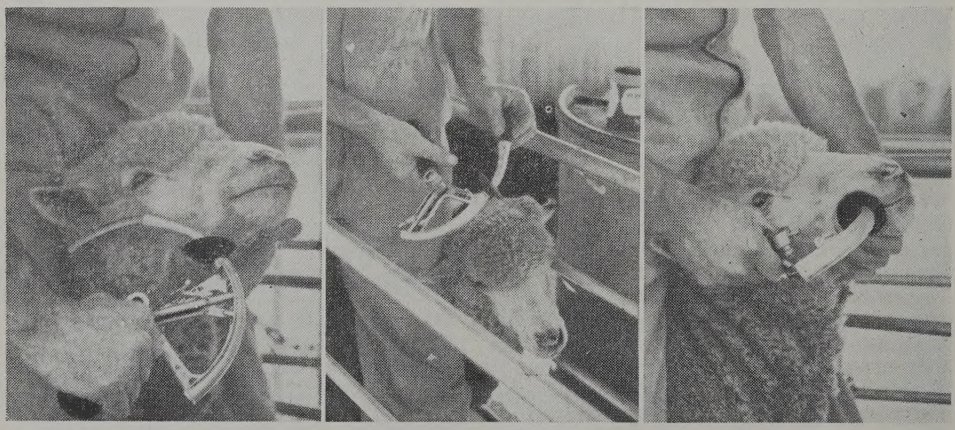

Fig. 6.—Another popular type of gun

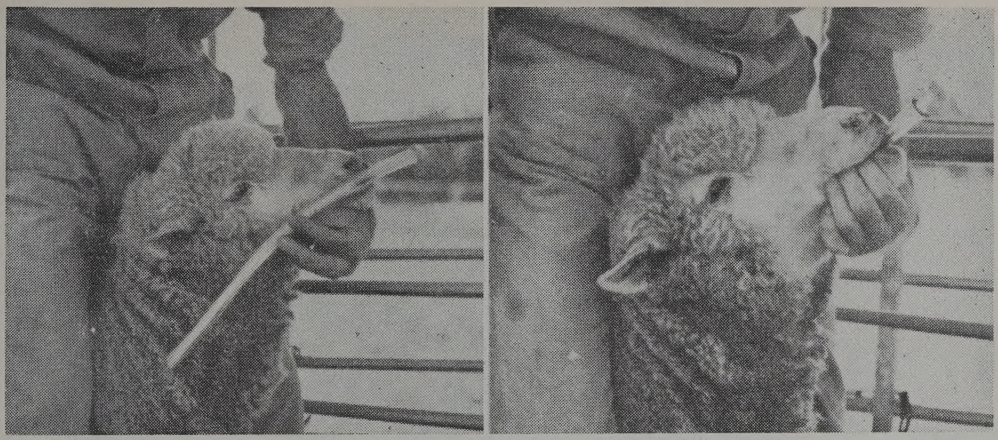

Fig. 7.—A home-made pellet administrator consisting of a 1 ft. length of plastic hose with plunger

licks regularly and in sufficient quantities to ensure adequate supplies of cobalt. Supplementing the water supplies presented certain problems and drenching had to be carried out at not more than weekly intervals to be fully effective. The cobalt bullet has been shown to supply the required quantities of cobalt over long periods.

Several types of pellet guns are available commercially for administering cobalt bullets to sheep and two types are shown in the accompanying illustrations.

A cheap and effective gun can be made from a 12 in. length of plastic hose with an internal diameter of ½ in. A cane or other flexible plunger is used to eject the pellet. The plunger should be fitted with a stop, such as a rubber or metal collar or a short length of No. 8 fencing wire passing through the cane.

The ends of the hose should be rounded and the stop should be positioned to ensure that the plunger, when depressed, does not project beyond the end of the hose.

To administer the bullet, the plunger is withdrawn slightly and the bullet slipped into the end of the hose. Wet the hose if the pellet is too tight. The hose is then slipped into the sheep's mouth and gently pressed into the gullet. The plunger is depressed as far as the stop, thus placing the bullet where it may be readily swallowed.

It has been found that occasionally—particularly in suckling lambs—the bullets in the reticulum become coated with calcium phosphate to such an extent that the cobalt is unavailable to the animals. Following treatment with the bullets, the animals should be observed at fortnightly intervals for two months or more. Any which fail to show the usual dramatic response should be re-dosed.

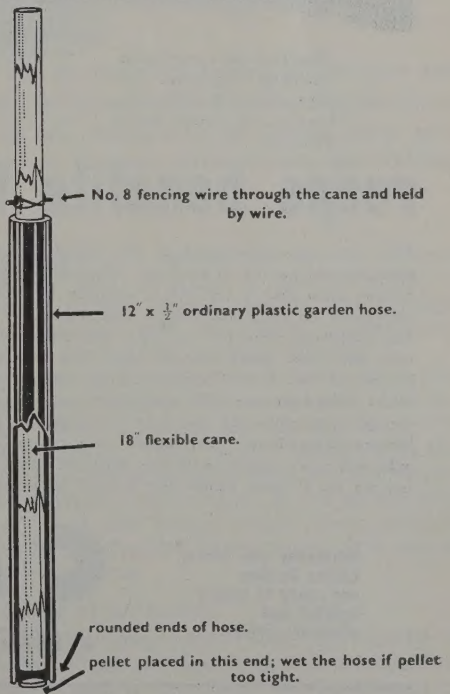
No. 8 fencing wire through the cane and held by wire.
12" x ½" ordinary plastic garden hose.
18" flexible cane.
rounded ends of hose.
pellet placed in this end; wet the hose if pellet too tight.

Fig. 8.—A diagram showing details of construction for the home-made gun as used for sheep

Victorian Farmer

Illustrated above is an onion-skimming implement designed by Mr. Charlie Loveday, of Lovely Banks, Victoria.

reaps benefits from own invention

This device was constructed by Mr. Loveday from pieces of steel he had on his farm. His own portable welding plant and a few S.A.E. spanners were the only pieces of equipment used in construction.

The implement consists of an onion skimmer, onion rakes and front wheel clearing rakes. The skimmer is made of two 3′ x 4″ cambered high-tensiled steel blades welded on two mild steel plates mounted on the belly equipment of the tractor and raised and lowered hydraulically. The onion rakes consist of mild steel rods attached to the rear hydraulic assembly and are set 5′ apart immediately behind the tractor closing to 2′ apart at the end of the rakes. The rakes move the onions into 2′ rows for maturing and easy collection.

The front wheel clearing rakes are constructed from mild steel rods welded to a tubular steel spring-loaded frame. The rakes clear a path for the tractor wheels preventing damage to the onions during sowing and harrowing.

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Fig. 1.—A lamb suffering from tetanus. Note the rigid limbs and head and neck bent backwards.

DISEASES FOLLOWING UPON LAMB-MARKING

By F. C. Wilkinson, B.V.Sc., Veterinary Surgeon

LAMB-MARKING is an essential feature of the flockowner's annual programme and includes ear-marking, tail-docking and the castration of male lambs. Because these operations result in the infliction of wounds or the destruction of tissues, they provide ideal sites for the entry and multiplication of disease germs unless precautions are taken to guard against infection.

The principal diseases which are apt to occur following marking operations are tetanus, arthritis, gangrene and caseous lymphadenitis (cheesy gland). Tetanus and gangrene can cause serious mortalities in lambs, while the other two diseases can be responsible for deformities and can seriously impair the animals' growth.

TETANUS

The micro-organisms or germs which cause tetanus are widely distributed as spores in the soils of cultivated lands and in animal droppings. For this reason, lamb-marking should never be carried out in old sheepyards, stockyards or other places where animal manure is, or has been, plentiful. The soil, and the dust rising from such yards can be heavily contaminated with tetanus spores and upon gaining access to a wound, the spores multiply rapidly and produce a deadly toxin or poison which affects the nervous system and causes the muscular contractions which are typical of this disease.

Unlike most other germ infections, the tetanus organisms themselves do not invade the live tissues and do not enter the bloodstream. They remain localised in the wound, inhabiting the dead tissues where they thrive and multiply in the absence of air. It is the poison which they produce which invades the bloodstream and causes the symptoms.

Method of Infection.

The tetanus spores have no ability to move and are carried from the surrounding sheep yards or paddocks to the wound or the wool around the wound in the dust and dirt. Sheep marked in sheep yards, where

there are usually greater numbers of spores, naturally have more chance of the spores becoming attached near the wound. This is especially so if the yards are dusty at marking time or the lambs are allowed to lie down.

Once these spores are present, nothing happens unless they become buried in the moist inflamed tissues of the marking wound. Here the spores, which are the sleeping stage, become active and multiply rapidly, resulting in a large number of tetanus germs all giving off their poison into the bloodstream of the lamb.

Symptoms.

These are usually seen from three to 21 days after the tetanus spores have gained entrance to the dead tissue.

The earliest symptom seen is a stilted gait, this being due to muscle contraction causing the sheep to be unable to bend its joints. This condition progresses until the stage is reached where the animal is unable to stand, so that a sheep affected by tetanus is almost invariably found stretched out on its side. The legs are rigidly extended and the head and neck bent backwards. Due to contraction of the jaw muscles, the jaws are locked together and the mouth cannot be opened, a symptom commonly known as "lock-jaw."

The third eyelid, which is found in the inside corner of each eye and is not usually visible, is commonly seen half-way across the eyeball. If this symptom is seen and the lamb is stiff all over, there is little doubt that the lamb is suffering from tetanus. However, in some cases lambs will die from tetanus without the third eyelid becoming visible.

Post Mortem.

Nothing abnormal can be seen on opening a sheep which has died from tetanus.

Treatment.

Once the toxin has reached the nervous system and symptoms are present, treatment is of little value. The disease is usually fatal, death occurring within a few hours to a few days of the appearance. Recovery can occur even after symptoms have developed but such recoveries are rare.

Prevention and Protection.

Normally if lambs are marked in temporary yards where there are very few tetanus spores and then placed into a fresh green paddock, few cases of tetanus should be seen. When a sharp knife is used for marking and a clean cut is made, the resulting wound heals quickly with little moist dead tissue in which tetanus spores, even if present, can "come to life" and multiply. If, however, much bruising of tissue occurs due to using a blunt knife, or if a dressing such as stockholm tar is placed on the wound, there is delayed healing and much moist inflamed tissue in which the spores can develop.

On some properties, no matter what precautions are taken, cases of tetanus still occur and cause death. On these properties, the farmer has a choice of two products to prevent tetanus.

1. *Tetanus Anti-toxin.*—If 1 cc. of the commonly prepared anti-toxin is given as an injection under the skin, then the lamb will immediately be protected from tetanus toxin for at least two weeks. The anti-toxin is taken up by the bloodstream and immediately neutralises any toxin present in the blood. The cost of the anti-toxin is approximately 16s. per 100 sheep and the injection can be easily given with an automatic syringe and needle at marking time.

2. *Tetanus Toxoid.*—This product is a vaccine, which, if given as a 1 cc. injection under the skin confers to the lamb, a strong and lasting immunity. The immunity in this case builds up gradually over a period of 14 days from the time of injection. Consequently, it provides little protective value if injected at marking time as many cases of tetanus could occur before the immunity is built up. The cost of the toxoid is approximately the same as the anti-toxin.

If it is desired to give immediate protection at marking and also immunity for a year, 1 cc. of tetanus anti-toxin can be injected at one site and 1 cc. of tetanus toxoid at another site on the lamb.

The use of rubber rings with the resultant dead tissue, provides conditions somewhat similar to those produced by the blunt knife. On some properties, rubber rings have been used successfully for years without any cases of tetanus resulting, but on other properties, tetanus has become a

source of alarming losses and owners have had to resort to the use of anti-toxin at the same time as marking to prevent losses. No matter which method of marking is used, a close watch should be kept on the lamb flock for at least three weeks following marking. Should cases of tetanus occur, it is advisable to administer anti-toxin to all the marked lambs. This provides an immediate protection to all unaffected lambs and prevents further losses.

ARTHRITIS

This condition results from organisms, which are present in the soil, gaining entrance to the bloodstream by way of tailing and castration wounds. The organisms having gained entrance to the bloodstream show a predilection for the joints, especially those of the limbs, in which they set up inflammatory changes causing arthritis.

Two common types are seen in sheep in Western Australia.

1. *Suppurative type*—so called because the cavities of the affected joints are full of pus.

2. *Non-Suppurative type*—in which there is marked lameness, but often no swelling of the affected joints. This is by far the most common type seen in Western Australia.

Symptoms.

Suppurative type.—Usually occurs within two to three days of marking. Intense lameness with swelling of one or more joints is seen. In acute cases, large amounts of pus form, and the joint may burst, resulting in a discharge of pus. Frequently however, death occurs as the result of a toxaemia. In those cases which do recover, there is usually some permanent deformity resulting from the damage to the joint.

Non-Suppurative type.—This form commonly occurs 10 to 14 days after marking. Affected lambs are dull, cease to feed and spend much time lying down. When forced to move, they are obviously in much pain. If one leg only is affected, there is a distinct limp, while if two or more limbs are affected the gait becomes very stiff and cramped.

Externally, the affected joints often appear normal in appearance, although sometimes there is slight heat and swelling present. The joints commonly affected are the knee, hock and stifle joints.

In affected flocks, nearly all the lambs may develop the disease, while in others only occasional cases are seen.

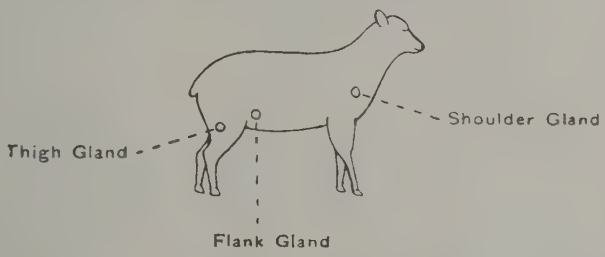

Fig. 2.—Sketch showing the location of the lymphatic glands commonly affected by caseous lymphadenitis.

Deaths from arthritis are not common, and losses of over 5 per cent. of the flock during the acute stage of the disease are rarely seen. The majority of the affected lambs make a complete recovery from a few days up to three weeks after the onset of symptoms. In a small percentage of cases, affected lambs become chronically lame and may cease to thrive. In the chronic cases, the affected joints are

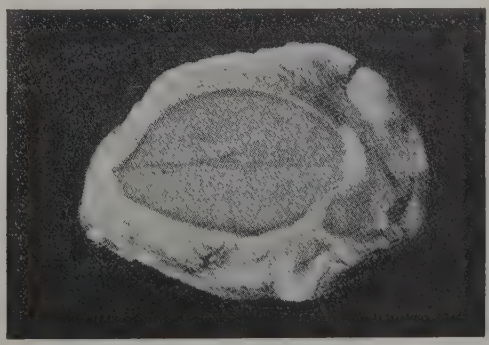

Fig. 3.—Lymphatic gland abscess cut open to show the cheesy substance, surrounded by fat.

usually enlarged and often the ends of the bones are joined together, so that the joint remains permanently stiff.

Post Mortem.

Suppurative type.—The affected joint cavities are full of yellow-green pus, and the ends of the bones which are normally smooth are eroded and very rough. Small abscesses may also be found in the liver or kidneys.

Non-Suppurative type.—On opening the affected joints, there is an excess of cloudy fluid and usually some roughening of the ends of the bones forming the joint surfaces. In chronic cases the tissues around the joint are thick and tough, while the joint surfaces are rough and uneven with (sometimes) adhesions present between their surfaces.

Treatment.

In the suppurative form of arthritis, early treatment with penicillin injections will kill the infective organism and help to bring about recovery of the affected lambs.

The majority of lambs affected with the non-suppurative type recover without treatment. As commonly nearly the whole of the flock is affected during an outbreak, and as any treatment used is expensive, treatment during the acute stage is of doubtful value. In sheep of special value, penicillin injections have proved useful if given before irreparable damage has been done to the joint.

Prevention.

As there is no protective vaccine for arthritis, the only means of prevention is to avoid the bacteria getting in through the marking wounds. The bacteria are usually more plentiful around the sheep yards and many cases can be avoided by marking in temporary yards in the paddock.

On some properties where the knife is used, cases are still seen even though every precaution is taken at marking. In these cases, the use of rubber rings may decrease the incidence of arthritis. Any owner changing over from the use of the knife to rubber rings should, however, be well aware of the increased possibility of deaths due to tetanus and gangrene infections.

GANGRENE

This is a wound infection caused by germs commonly known as gas-gangrene bacteria, which are commonly found in the soil and surroundings of the sheep yards. Ideal conditions for their development and growth are in dead or inflamed tissue which is still moist, such as a stump of a tail which has not healed properly or in the inflamed area surrounding a rubber ring. The gas-gangrene bacteria once established, multiply rapidly and gradually invade the normal healthy tissue adjoining the dead or inflamed part. They cause swelling and discolouration with much gas formation in the affected tissues.

Toxins are produced which when absorbed into the general bloodstream, cause a blood poisoning which results in the death of the animal.

Symptoms.

If seen before death, the affected lambs are depressed and show some evidence of muscle tremors or a stiff gait in the hindlegs. A close examination will show the skin around the wound to be a greenish-black colour. The area under the skin will be swollen and filled with gas so giving it a soft doughy feel.

Post Mortem.

Examination of a dead sheep will reveal a gangrenous condition of the muscle and the skin around the wound. When cut open the tissues around the wound will be seen to be full of gas bubbles and a reddish-brown or greenish-black fluid will come away.

Treatment.

This is not usually practicable in flock lambs, but with very valuable animals, penicillin injection to kill the infection and an anti-toxin to neutralise the absorbed toxins will increase the animal's chance of survival.

Opening of the swelling and washing out with hydrogen peroxide followed by the sprinkling of sulphonilamide powder into the wound is a cheap and fairly efficient method of treatment.

Prevention.

If normal hygiene measures are used at marking, no cases of gangrene should be seen.

Severe mortalities have been seen in lambs in which a ring has been placed around the tail and the tail cut off one-half inch below the ring, leaving one-half inch of dead tissue for the organisms to grow in. Other mortalities have been seen where the marking wounds have been dressed, using a piece of germ-laden wool to apply the medicament.

Fig. 4.—Enlarged shoulder gland almost ready to burst.

CASEOUS LYMPHADENITIS (CHEESY GLAND)

The bacterial micro-organisms causing this disease are usually present in large numbers in the soil and droppings around the sheep yards and at marking time they can gain entrance through the skin wounds.

The bacteria enter the tissues and are usually arrested by the lymph (drainage) glands where they multiply rapidly to form abscesses. These abscesses which are full of yellow-green pus, usually become encased in fibrous tissue. When this occurs, the purulent material becomes calcified and the abscess remains in this form for the duration of the life of the sheep. Sometimes, however, they break through the skin and discharge their pus contents, then heal over. Occasionally organisms break out and enter the lymphatic system, only to be arrested in another gland where an abscess forms as already described. In rare cases, the organisms get into the bloodstream and are taken to the chest cavity where they multiply, growing into large abscesses and can cause death of the sheep.

Symptoms.

The only symptom seen in the live sheep is a swelling under the skin in cases where the superficial glands are involved. The glands commonly affected after marking are the flank glands and the thigh glands.

At slaughter, the abscesses are readily seen when the skin has been removed. The abscesses can easily be taken out and if cut they are seen to contain a considerable amount of yellow-green pus which will be quite soft in a recent case, but hard and dry in an older case.

These abscesses are a source of considerable economic loss in connection with fat lamb production as the removal of affected glands at abattoirs prevents the acceptance of the carcass for export.

Prevention.

If hygienic methods are used and the lambs are marked away from the sheep yards, this disease should not be a problem. When rubber rings are used, very few cases of cheesy gland are seen.

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Fig. 1.—This specimen was forwarded in a box in an unpressed condition. Drying out and rough handling resulted in the leaves and flowers becoming detached and broken

PLANT SPECIMENS FOR IDENTIFICATION

By R. D. ROYCE, B.Sc. (Agric.), Senior Botanist, and N. G. MARCHANT, Herbarium Assistant

PLANT names and the naming of plant specimens are of fundamental importance in the science of botany. In applied botany as well, proper identification is of the utmost importance. In agriculture for instance, accuracy in naming poisonous plants and weeds, as well as fodder and pasture species, can save farmers considerable sums of money, and may be responsible for avoiding heavy stock losses.

The most important requirement for the successful naming of a plant is a good specimen to work with. Too often, damaged or insufficient material is submitted to the State Herbarium and Botanical Branch of this Department, and while some of these specimens can be named with a fair degree of certainty, and others named with some doubt, the majority cannot be classified at all, until better material is made available.

Perhaps the most common cause of unidentifiable material is the practice of crushing a number of pieces of scrub into a shoe-box or paper bag and posting the package to the Department of Agriculture. The specimen invariably arrives at its destination as a collection of bare dry sticks with a mass of detached and withered leaves, flowers or fruits at the bottom of the container. (See Fig. 1.)

Other parcels are lined with damp newspaper or greaseproof paper, while stems are frequently pushed into a piece of potato to keep them fresh. Or again a piece of scrub is crammed into a plastic bag, with or without damp cottonwool or newspaper. When such specimens are in the mail for only a short time, these methods may keep them fairly fresh, but if there is any delay in transit the plants are liable to a heavy mould development which renders them unrecognisable. (See Fig. 2). In any case, dried and pressed material is just as convenient to work with as fresh material. The collection and preparation of good specimens is neither difficult nor tedious, and may be carried out successfully by almost any member of the family.

THE SPECIMEN

When selecting material for the preparation of a botanical specimen, many factors have to be considered.

In the case of small herbs, the whole plant including roots should be taken, and when collecting those which have only one flower per plant, a number of such plants should be gathered and treated as the one specimen. It is particularly important that small plants which have the leaves

Fig. 2.—A specimen forwarded in a plastic bag. A heavy growth of mould destroyed the important structures

concentrated in basal rosettes at ground level, and with erect leafless flowering stems, should be gathered with leaves and stems intact.

Grass specimens should be collected in this manner, so that they show the base of the plant, the roots and the barren stems as well as the flowering stem. Those grasses which produce a wide spreading seed-head need to be carefully selected. Usually a young developing head can be found which is much smaller than a fully-matured one, but where no young one is available, a larger specimen can be pared down by removing a proportion of the branches in the seed head, or by taking only the top section.

When collecting a specimen from a tree or shrub, it is essential that the piece taken should be truly representative of the plant from which it came. Frequently single leaves or even leaflets are sent in for identification, but specimens of this nature can rarely be named, and then only if they possess some characteristic aroma or peculiarity of structure which is well known.

To be of maximum use a specimen should be at least 9 to 10 in. in length and show the arrangement and attachment of the leaves on the stem, and should carry a number of buds, flowers or fruits. Where possible all three should be included, as a complete series of these structures makes positive identification much easier, but if only one of these is available, it should be forwarded with the attached leaves. Generally speaking it is advisable to take at least two specimens to allow for accidents and to provide a duplicate set when forwarding for identification.

Special care is required when selecting material from species of Eucalyptus, the so-called gum-trees of Australia. These species cannot usually be distinguished from leaf material alone, and buds, flowers and fruit are generally essential for a completely satisfactory identification. Many groups of Eucalyptus have buds which are similar both in size and shape as well as in ribbing and markings, but differ completely as to fruit. Others have similar fruit, but differ in the buds. Under these circumstances complete material is very important, but is not always available on the tree.

However, much can still be done under some circumstances to provide better material. If all the buds have burst and the tree is in full flower, bud-caps (opercula) can usually be found on the ground below the tree. These, together with the flower, will give the full picture of the original bud. Similarly, if no fruit can be found on the tree, these can frequently be obtained from the ground. Where material is obtained by this method, care should be taken to ensure that no other species are growing close by. As far as possible these specimens should be gathered from isolated trees or from among a clump of trees of the one species. A specimen of bark is also useful in providing additional characters to assist in identification.

A large number of trees and shrubs have been introduced into Western Australia from other countries and are being grown in gardens throughout the State. Specimens from these are frequently submitted for identification, and because of their general dissimilarity in structure and habit as compared with the native vegetation, complete material is even more important than it is for the local flora. Garden plants are usually under the close observation of gardeners, both professional and amateur, and complete material should be available, since a specimen bearing buds and flowers can be taken for pressing when available, and forwarded for naming later in the season when a fruiting specimen can also be obtained.

There can be no doubt about the fact that for positive identification, flowers and fruit are necessary. But these are only available for a short time during the year, and on many occasions urgent identification has to be attempted at times when they are not available. This is particularly important in connection with stock losses from poisonous plants, as these losses frequently occur in the summer and autumn when the plants are completely devoid of all traces of flowers and fruit.

Fortunately a very large proportion of the native poisonous plants can be readily recognised, even in the absence of flowers. Each has its characteristic habit, leaf shape and arrangement, as well as soil requirement, and the naming of these plants as they occur in their native habitat is comparatively simple. Insofar as a flowerless specimen reflects the character of these plants and is well prepared, it too can be readily named. Where no attempt has been made to prepare the specimen, it is quite possible that it will not be recognised when submitted for naming. When the original plant material is not complete, the specimen should be prepared with the utmost care, in order to compensate for the lack of flowers.

THE PRESS

In preparing a botanical specimen from a branchlet of a plant some means of flattening and drying it is necessary. Many elaborate and costly gadgets have been devised for pressing specimens, and each has some particular advantage under the right circumstances. But these are not really essential.

When only one or two specimens are being prepared, no elaborate precautions are necessary. Invidual plants, particularly herbs and other slender species, can be laid out between pages of a book, or into the fold of the daily paper. Pressure can then be applied by placing two or three books or newspapers on top. Except under exceptional circumstances this procedure would be adequate for producing a completely satisfactory specimen, as there would be a sufficient thickness of paper to absorb all the moisture and dry the plant before fungus developed.

Fig. 3.—A well-prepared specimen of Matilija Poppy *(Romneya Coulteri)* showing opened flower, flower bud and leaf arrangement

When preparing a number of specimens at the same time, it is necessary to use a plant press, and a cheap and effective one can be made by using a pile of folded newspapers, two boards of appropriate size and a leather strap or length of rope

by means of which pressure can be applied to the bundle. (See Fig. 4.)

The most useful size of paper for the average specimen is approximately 10 inches by 12 inches, and this is obtained by folding sheets of the daily paper in halves. For small herbs, grasses and other plants without much woody tissue, only a single folded sheet is necessary. This would give four thicknesses of paper between each plant, but when the plant is woody, or has rigid leaves, or when it is succulent and contains excessive water (e.g., samphire) two or three times as many thicknesses as this are necessary. The function of the paper is not only to absorb moisture from the plant, but to transmit firm pressure so as to flatten it, and for this reason it is better to err on the side of too many thicknesses, rather than to cut them to a minimum.

PREPARATION

The actual preparation involves some patience but little real skill.

The press is set up by taking one of the boards and placing a few thicknesses of paper on it. The first specimen is then laid on the paper so that when pressed all the structures will be visible. If it is excessively leafy, some should be removed so that the flowers and fruits will not be obscured. The specimen is then covered by further thicknesses of paper and pressed flat by applying pressure with the hands. A further specimen is placed on top, arranged, and pressed flat, the amount of paper used each time being determined by the nature of the specimen. It is important that they should be placed on top of each folded paper and then covered by another folded paper, and not placed inside the fold of each sheet. If arranged in the latter manner, they could be overlooked during subsequent changes of paper, and lost.

This procedure, alternating specimens and sheets of paper, is continued until all the specimens have been placed in the pile. The second board is then placed on top of the last papers, and the leather strap or rope is passed round the whole and drawn tight. When first put in the press, the specimens should be subjected to maximum pressure by the tightening of the rope or strap as much as possible. This is particularly important as during the first 24 hours under pressure a great deal of moisture is removed and a considerable degree of flattening is achieved.

After the plants have been in the press for one day the strap is released, the layers of wet papers are removed and the press built up again as before, using fresh papers. This time the pressure should be less than on the previous day, and should then be eased off successively with each change of paper, until when the last change is made practically no pressure need be applied. This allows a freer circulation of air to assist in the final drying out. The number of changes that will be necessary will depend on the air temperature and general weather conditions, as well as the type of specimen, but four or five changes should usually be sufficient.

By this time the plants should be quite flat and sufficiently dry to be left in the last change of paper until packed for the post. If for any reason specimens are kept for any length of time before posting, a little naphthalene or other insect repellant should be sprinkled over them. For posting, it is only necessary to have one sheet of newspaper between each specimen, though it is essential to have stiff cardboard on the top and bottom, or to have the bundle packed in a cardboard box to prevent damage in transit.

HERBARIUM PRACTICE

It is partly by means of specimens forwarded by farmers, naturalists, foresters and others interested in botany that the collection of plant material in the State Herbarium is built up. For this reason a well-prepared specimen showing all the structures necessary for identification, and being large enough to show the habit of the plant, is of special importance. It is the practice of Herbaria throughout the world to regard all plant specimens submitted for naming as being the property of the institution concerned, and plants are not returned to the collector except under exceptional circumstances.

For this reason all specimens submitted for naming should be clearly numbered for easy recognition. The easiest method of doing this is to attach a numbered piece of paper to the stem of the specimen by means of cellotape, cotton or by some

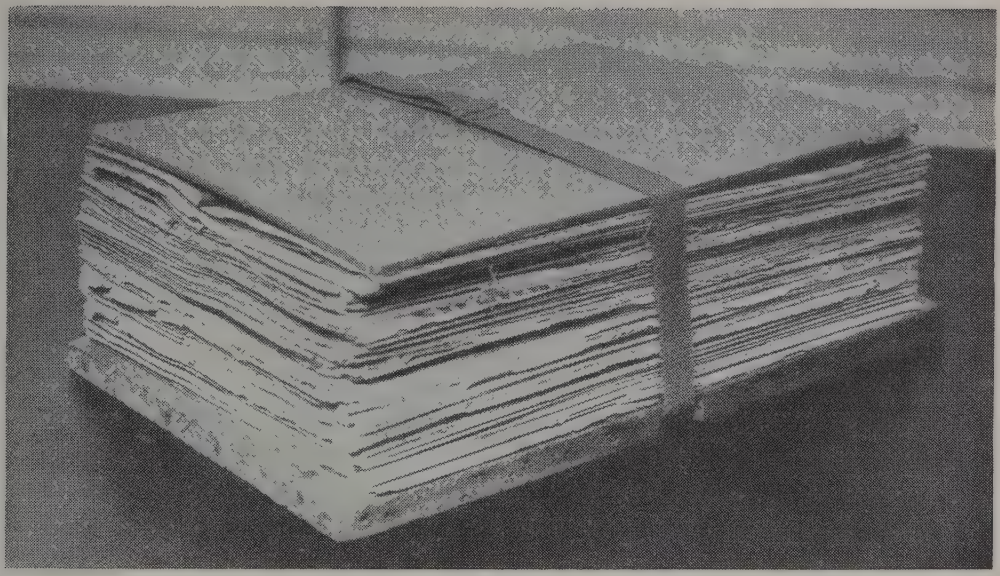

Fig. 4.—A useful type of plant press. The bottom board has a slot to take the strap. The top board is of cloth-covered plywood

similar means. Merchandise price tags can also be used, but whatever means if employed, the number should be firmly fixed onto the plant material. Two pieces of each plant should be tagged with the same number. One is then forwarded to the State Herbarium and the other is retained for reference and comparison with the list of identification when it is received.

The value of these specimens can be greatly increased if a few notes concerning each plant are forwarded with the pressed material. These notes should give details which are not readily obtained from the specimen itself. Such things as size of the plant, soil type in which it grows, associated vegetation, colour of flower, locality and date of collection are of importance, and could assist materially with the identification. Even of greater importance when submitting specimens of exotic plants for naming, are details of the country of origin, or the history of the plant, where the seed originated, and any peculiarity of the plant concerned. Under some circumstances a relatively poor specimen can be named with certainty, if full and detailed notes about the plant are available.

Lastly it is most important that the name and address of the sender should be placed inside the parcel. If these essential details are only recorded on the outer wrapping of the parcel, as it so frequently is, it is comparatively easy to lose the identity of specimens when several are delivered at the Herbarium at the one time. Perhaps the ideal arrangement is to include a covering letter in the parcel with the specimens.

SUMMARY

When submitting plant specimens for identification the following points cannot be emphasised too strongly:—

(1) Select representative specimens.
(2) As far as possible obtain flowers or fruits.
(3) Press and dry the material between newspaper.
(4) Prepare notes concerning each plant.
(5) Number duplicate sets of specimens.
(6) Pack tightly for protection in the post.
(7) Forward to Government Botanist, Department of Agriculture, Jarrah Road, South Perth.

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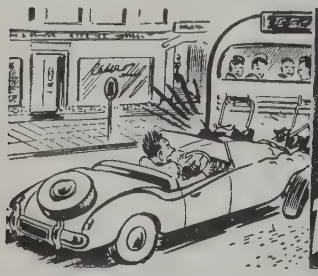

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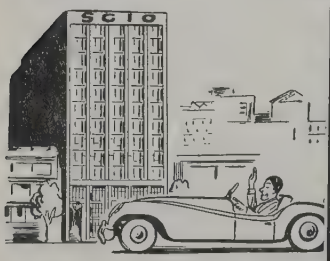

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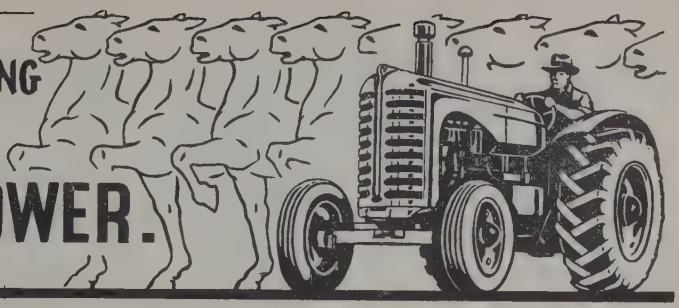


By F. R. STANLEY*

AT the last Perth Royal Show, a farmer accompanied by his young son was deeply immersed in a discussion with a tractor salesman. The youngster eyed the display machine carefully as his elders discoursed on belt horse-power and drawbar horse-power. Finally he said, "What ARE all these horse-power things Dad—I can't see 'em?"

I felt at the time that the boy's question was one that many adults might well have asked.

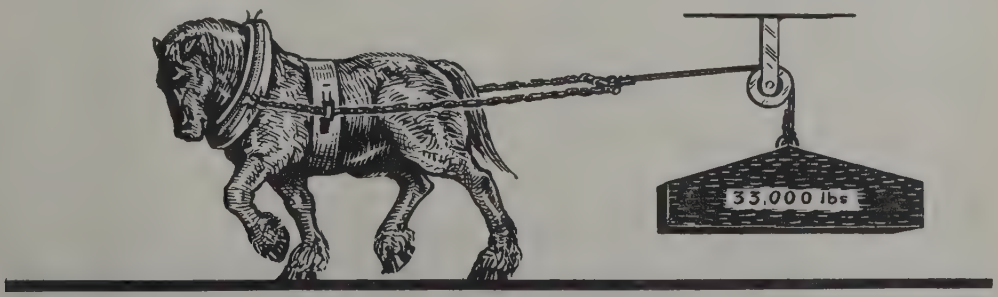
Horse-power is something that does not show—in fact it is something so elusive that the average tractor-buyer has to take someone else's word for its existence and its measure.

How many of my readers—even tractor-owners of many years standing—could have answered the boy's question with any degree of confidence?

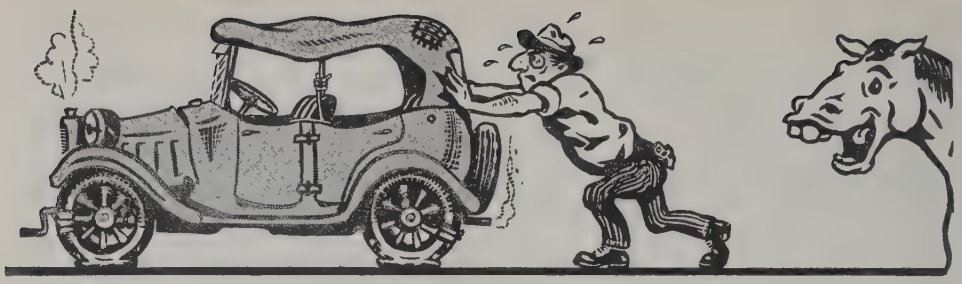
Possibly most of you know that the standard horse-power is the power needed to lift 33,000 lb. one foot in one minute or in other words it is 33,000 foot-pounds per minute—but how many of you know how it is applied in giving the drawbar horse-power of your tractor?

I have seen many attempts made to explain this in simple, layman's language but cannot recall any better explanation than that given by Mr. John McClelland when writing in "Stock and Land" a few years ago. I have taken the liberty of reprinting portion of his article as he has given an explanation which is clearer and more concise than anything I could hope to write. He says:—

> This is no realm of the mighty mathematician or of the highly trained engineer; it is a simple field open to everyone who can multiply 2 x 2, but it is necessary to get hold of a few simple concepts—force, work and power.
>
> The idea of force is simple enough —we all know that we exert a force when we say push against a car, and provided the car does not move, that it pushes back with an equal and opposite force.
>
> If we succeed in pushing the car by exerting a force of, say, 55 lb. and if



* W.A. Tractor Sales Manager, Ford Motor Company of Australia Pty. Ltd.



we have moved it, say 10 ft. then we have done some work and this work is equal to 55 x 10 or 550 foot pounds.

Power is the rate of doing work, so if we succeed in pushing the car again with a 55 lb. push and over a distance of 10 ft. in say one second, we have worked at a rate of 55 x 10 ft. lb. per second, or 55 x 10 x 60 ft. lb. per minute. This is measured reasonably enough in foot pounds per minute.

The familiar unit of power is the horse-power and is equal to a working rate of 33,000 foot pounds per minute. So in our case we have exerted:

$$\frac{55 \times 10 \times 60}{33{,}000} = 1 \text{ horse-power.}$$

We can work out the power necessary for any operation if we know the drawbar pull necessary to handle an implement and the speed of operation by the simple formula:—

$$\text{Horse power} = \frac{\text{drawbar pull x speed, in feet per minute}}{33{,}000}$$

and for simplicity, 1 mile per hour = 88 feet per minute.

TRACTOR TESTS

Now that we have some idea of what horse-power means, we can proceed to link up our knowledge with practical tractor work.

As I said previously, horse-power is something we cannot see—and the tractor-owner has to take someone eles's word for its existence and its measure. In these days, that "someone else" is usually the manufacturer of the tractor or his representative, who gives details of the drawbar horse-power and belt horse-power in the published specifications. In these days too, that information is usually fairly accurate and in many cases it is supported by "Nebraska Test" or "Australian Tractor Testing Committee" figures.

The Nebraska Test.

In the "bad old days" some tractor manufacturers took advantage of the fact that horse-power could not be seen, and endowed their machines with quite fictitious horse-power ratings in order to boost sales. If one manufacturer's chief rival in the sales market was say a 35 h.p. model, he would claim that his product was in the 40 h.p. class—and who was there to dispute it?

This kind of deception became so common that in 1919, the State of Nebraska, U.S.A., introduced a law which, in brief, stipulated that a tractor could only be sold in that State if its advertised horse-power was supported by tests carried out at the University of Nebraska; if it had operated under test without serious mechanical breakdown, and if the manufacturers showed that they had adequate supplies of spare parts available within the State.

The manufacturers had to submit stock models for testing, and only those which passed the test were given permits for sale.

This law only applied in the State of Nebraska but its repercussions soon spread throughout the U.S.A. and almost throughout the world. The Nebraska test figures were insisted upon by farmers, and buyer-resistance to untested models was such that fictitious horse-power ratings soon became a thing of the past.

Other Standard Tests.

The demand for authoritative figures, backed by some independent testing authority, led to the establishment of tests in other countries. In Britain they are conducted by the National Institute of Agricultural Engineering (N.I.A.E.) and in Australia by the Australian Tractor Testing Committee which has a testing station located in the Victorian Department of Agriculture's State Research Farm, Werribee.

The Station is financed jointly by the Commonwealth and all State Governments, and the testing work is done by the University of Melbourne. The tests differ only in some details from those conducted at the University of Nebraska. The activities of the station are controlled by the Tractor Testing Committee, representing the Commonwealth, the States and the University.

DETAILS OF AUSTRALIAN TESTS

The following details of the testing procedure were given recently by Mr. G. H. Vasey, B.C.E., A.M.I.E., Aust., the Officer-in-Charge of Tractor Testing.

The station is equipped to carry out tests on tractors, engines, spark arresters, and on tyres, fuels, and other agricultural automotive equipment.

The station's clients are chiefly manufacturers of engines and tractors and like equipment, who see the point of having their product tested by an independent testing authority. There is no compulsion about it, as there is by law in Nebraska (U.S.A.).

If the tractor is a stock-model, i.e., in production for sale, then the test is published for all to see. Farmer's editions of tractor tests have been published in most of the State Journals of Agriculture within the last year or two. For a prototype, not yet in production, the company may seek a private test, for its own information; such a report is not published.

The standard procedure in testing a tractor, according to the test code, is in three main parts—(i), tests on the engine when driving through the belt, i.e., the belt tests; (ii), tests on the tractor as a whole when towing through the drawbar, i.e., the drawbar tests; and (iii), inspection for wear or damage, and generally the examination of the tractor as a whole.

In the belt tests the engine is loaded by the belt-driven dynamometer, which can apply and measure any suitable power demand on the engine. The belt tests establish the maximum belt power of the tractor, at rated engine-speed; they also show the engine performance over the governed range, and on overload with full throttle. Fuel consumption is also measured.

In the drawbar tests the tractor is made to tow a load which can be controlled and varied, and measured, from light to heavy pulls. Road speed and wheel slip are also measured, the product of pull and speed being drawbar horse-power.

Pull, speed and slip, with the engine running at rated speed, are measured in all gears; since, at rated speed, the engine is at full throttle these runs correspond to full engine power, and so give maximum drawbar horse-power in each gear. The maximum power in "rated" gear establishes the maximum drawbar horse-power of the tractor.

The fuel consumption is measured in a series of runs in rated gear at various part loads, running in all for ten hours.

An important point to note is that the drawbar tests are run on a hard road, concrete or asphalt. The reason for this is that such a surface is a "standard" one, compared with soils which are highly variable; and such a surface is the same in all parts of the world. The result of this is that the drawbar performance in the field will usually be lower than in the tests.

The testing officers make many other observations on the tractor, for example the speeds of belt and power-take-off, the position of the centre of gravity, the placing and working of the controls, the instruments, accessibility, comfort and safety.

(End of quote.)

DRAWBAR PULL

The actual pulling power of the tractor —the number of pounds pull exerted at the drawbar—is possibly the most vital factor governing the farmer's choice of a machine.

This is easily tested with a dynamometer —an instrument similar to a glorified spring-balance which is attached between the drawbar and the implement being towed. As the tractor moves off, the actual pull in pounds is registered on the clock-face of the dynamometer.

Two tractors of the same make and horse-power can give vastly different pulling performances even though engine performances may be identical. Many factors can influence the final results but the three most vital are tyre pressure, weights of rear wheels and height of the drawbar.

Tyre Pressure.

For field work, air-filled tyres should be kept at the recommended pressures, which are usually the tried and tested "happy medium," best suited to give efficiency and economy. The lower the pressure—within reason—the greater the area of tread or gripping surface which comes into contact with the ground, but too low a pressure results in wrinkling of the tyre walls and increases the flexing of the tyre to an extent which soon weakens the fabrics.

Too high a pressure tends to leave only the centre of the tread in contact with the ground surface and this leads to excessive wheel slippage with increased tyre wear and higher fuel consumption. Over-inflated tyres do not "iron out" inequalities in the ground surface so the driver has a rough ride.

Be careful to keep the tyre pressures equal on the two rear wheels. Uneven pressures will cause excessive wheel slip on one side and this also results in power losses through friction in the differential, as well as an increase in fuel consumption.

Higher tyre pressures will be needed for roadwork and haulage at transport speeds than would be used for low speed field work such as ploughing and cultivating. High-speed work on soft tyres greatly increases operating costs.

Wheel Weights.

The addition of heavy rear wheel centres or the use of water-filled tyres is another method of reducing wheel slip—and excessive wheel slip can reduce the drawbar pull and increase tyre wear to a marked degree.

Some experts state that for every 120 lb. added to the rear wheels of a tractor, the drawbar pull will be increased by 90 lb. In Western Australia some farmers on a 36 h.p. maximum drawbar tractor are working satisfactorily, with rear wheel centres weighing 1,000 lb. each and also have their tyres three-quarters filled with water, giving them an overall rear wheel weightage of 2,880 lb., an increase of over 1,480 lb. upon the standard rear wheel weights of this type of tractor. These farmers have told me this extra weight has given a highly satisfactory tractor performance.

In England, most popular makes of tractors have light wheel centres, whereas in America, South Africa and Australia, there is a pronounced swing towards the heavy wheel centres. The type of farming and type of implement used may have some influence on this. In England where hydraulics are so popular, their three-point linkage control with the implement mounted immediately behind the tractor may be the reason. Here, the downward drag of the implement tends to bring about a reduction in wheel slippage although, even then, I am of the opinion that heavier centres would be an advantage. In America, South Africa and Australia with their "broad acre" farming the larger trailed implements make heavy centres a necessity.

Water-Filled Tyres.

In some popular makes of tractors marketed in Australia today, a special attachment for filling tyres with water is included as standard equipment, which illustrates the keen demand for water-filled tyres.

Two 14 x 28 tyres filled with 75 per cent. water will hold 88 gallons, thus adding 880 lb. to the overall weight on the rear wheels. Correspondingly, with 100 per cent. of water in tyres the weight will be increased by 1,108 lb.

With water in the tyres, the tyre pressure may be decreased to as low as 10 lb. per square inch. You will appreciate that the lower the pressure, the more adhesion or "grip" the tyre has on the ground.

Once you notice any wrinkling along the side walls of a tyre at maximum load, however, you will know you have gone

below the desirable minimum pressure at which you can work—and pressure should be increased until the wrinkling disappears.

With water-filled tyres, the pressure will remain constant for a longer period than if the tyres are air-filled but it is vitally important to have both tyres at the same pressure. As mentioned earlier, wheel slip will be accentuated if tyre pressures are uneven—with water-filled tyres and the heavier weight on the ground, unevenness in pressure will result in a still greater degree of wheel slip.

Drawbar Height.

Our final thought on controlling wheel slip is the height of the drawbar in relation to the load. Faulty drawbar positioning can cause excessive wheel slippage with corresponding loss of pulling power.

Remove the locking pins and let the drawbar "float" while you pull the implement a few feet on level ground. Then note the drawbar height correctly and lock it in that position, or perhaps an inch above to allow for weight transferred from front to rear wheels. With hill work, of course, you may have to lower the drawbar, but your own gauge for this will be whether your front wheels tend to rise or not.

With the above factors checked thoroughly, it is possible to reduce your wheel slippage in working gear to as low as 4 per cent—a simple adjustment, which in a year's operations will save a lot of time, labour and money, and enable you to produce at lower cost.

Testing for Wheel Slippage.

As a matter of interest to yourself, carry out the following test to see just what your tractor wheel slippage is and then see what reduction you can make by carrying out some of the points discussed.

Mark your rear wheel with a piece of chalk, and then drive the tractor unloaded until the wheels have made exactly 30 revolutions. The distance which the tractor has travelled is marked, and then the same course is travelled with the tractor under load.

The number of revolutions to complete the course under load are carefully counted, and the number of revolutions which the tractor made unloaded subtracted from the number of revolutions made under load.

For instance, the tractor under load may take 34 revolutions of the wheels to cover the same distance it covered in 30 revolutions when unloaded.

If we subtract 30 from 34 we have a wheel slippage of 4 revolutions in 34. To on pass this as a percentage we multiply the 4 by 100 and divide it by the number of revolutions made under load (34) and our answer is 11.7 per cent.

SAN JOSE SCALE CONTROL

The necessity of controlling San Jose scale infestation in commercial orchards is becoming a matter of increasing importance. This has been brought about by certain major fruit importing countries prohibiting the importation of any fruit infested with this scale insect.

During the last two seasons strenuous efforts have been made by the Department of Agriculture and all concerned within the industry to highlight the importance of controlling this pest. However, the action taken by growers, though quite successful in reducing scale numbers, will have to be considerably expanded if anything like complete control is to be achieved.

In some commercial fruitgrowing districts the presence of infested trees in backyard orchards can be regarded as a menace for the reason that young scale crawlers can be transferred by wind and on the feet of birds to clean trees in commercial orchards.

The importance of this matter has been accepted and a campaign is now being organised to apply to Bridgetown. In this town there are approximately 3,100 fruit trees. Many of these trees are badly infested with scale, as are other plants including roses and pussy willows. It is proposed with the co-operation of the householders concerned to effectively power spray all susceptible trees once during the winter and/or early spring, and up to three times during the summer. The cost of the spraying treatments will be free to occupiers having 12 or less trees, but full costs will be charged to occupiers who have more than 12 trees.

In addition to the spraying treatments action will be taken by inspectors to order the destruction of badly-infested trees and plants.

The campaign will be in operation for a period of up to three years and it is hoped that eradication will be achieved.

The cost of the spraying treatments will be borne jointly by the Department of Agriculture and the Western Australian Fruit Growers' Association through their Trust Fund.

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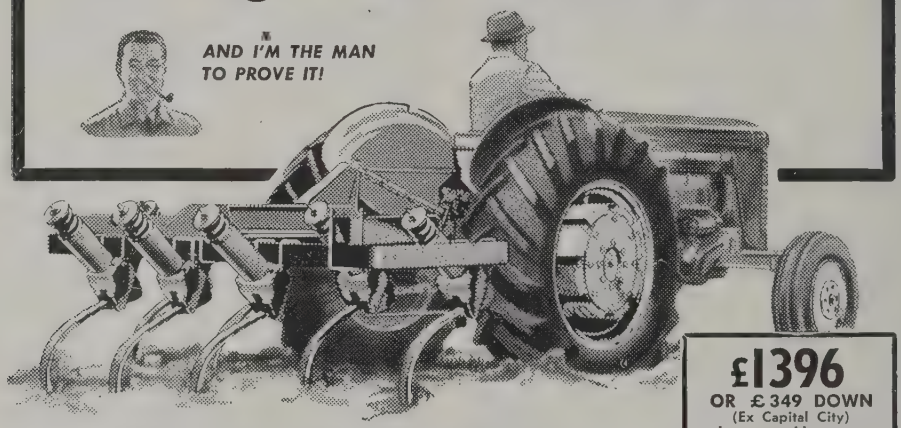

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Fig. 1.—Magnesium deficiency symptoms on shoot growth of Cleopatra apple.

Magnesium Deficiency of Apples and Oranges

By N. J. HALSE, M.Sc. (Agric.)
Research Officer, Plant Research Division

MAGNESIUM deficiency is a common problem of orchards in Western Australia. The deficiency affects both apples and oranges, but in most cases is not particularly severe. Leaf sprays of magnesium sulphate (Epsom Salts) have successfully controlled the deficiency. Two per cent. strength is recommended. Soil treatment to give long-term control has not yet been demonstrated successfully in Western Australia.

Magnesium is an essential element for all plant growth. Although it is not usually included in fertiliser mixtures it is needed in considerable quantities. Plants usually contain more magnesium than phosphorus, but magnesium is deficient less often than phosphorus because most soils contain adequate supplies of magnesium for successful plant growth.

Like potassium, magnesium is frequently present in greater quantities in the subsoil. Where intensive cropping of any kind is followed it is likely that the supplies of magnesium in the soil will be exhausted. Under these conditions crops show deficiency symptoms.

Magnesium is closely related to potassium in plant nutrition and excess application of potash frequently causes magnesium deficiency. The converse effect is not as common, although it can occur.

OCCURRENCE OF MAGNESIUM DEFICIENCY

Magnesium deficiency is fairly general on orchards in the fruit growing areas of the Darling Ranges within 25 miles of Perth. Pickering Brook, Kalamunda, and Karragullen are districts in which magnesium deficiency is found on apples and oranges. Symptoms of the deficiency have also been noted on other citrus species, and other fruit trees may be affected. In the South-West fruitgrowing districts, Donnybrook, Bridgetown and Manjimup, the deficiency does occur on apples, although generally speaking the soils in these areas have higher reserves of magnesium initially.

Magnesium deficiency is closely connected with cropping. Large amounts of magnesium are removed from the tree by

the developing fruit. Both in apples and oranges the magnesium required by the fruit is taken from the leaves and not directly from the soil. In consequence leaves which are close to developing fruit, particularly older leaves, first show magnesium deficiency symptoms. In very deficient areas a similar effect is seen on shoot growth of apples when the young leaves at the tip take magnesium from the older leaves at the base of the shoot. Movement of magnesium into fruit leads to a typical pattern of symptoms throughout the season on fruit trees, particularly navel oranges. The symptoms on navel oranges are usually at a minimum at the beginning of summer. As the fruit grows, magnesium is removed from the leaves and the symptoms start to show, increasing in intensity until June of the following year. In mid-winter there is usually a heavy leaf-fall in which all leaves showing severe magnesium deficiency symptoms fall off. The pattern is naturally somewhat different in apples; but the increasing severity of symptoms from October to January reflects the same process.

Fig. 2.—Leaves of Washington Navel orange showing magnesium deficiency ranging from severe to slight with unaffected leaves.

SYMPTOMS ON APPLES

Leaf symptoms of magnesium deficiency for apples are as follows:—

Most varieties show a marked yellowing around the margin of the leaf and in between the veins. As the deficiency increases in severity, this yellowing is followed by burning around the margins and then between the veins. The yellow or yellow-white of magnesium deficiency is quite different in colour from the pale green chlorosis caused by manganese deficiency. Another difference is that in magnesium deficiency the tip of the leaf is usually affected first, whereas manganese deficiency uniformly affects the whole leaf.

Doughertys and Yates do not show as much interveinal yellowing as other varieties; they tend to have only a marked yellow band around the outside of the leaf.

Typical symptoms of magnesium deficiency on older leaves of shoot growth of Cleopatra apples are shown in Fig. 1.

SYMPTOMS ON ORANGES

Symptoms of magnesium deficiency in oranges are as follows:—

Both Washington Navel and Valencia oranges show a pattern of yellowing on the

leaves; this starts as a yellow elongated blotch on each side of the mid rib, and increases in size until only the base and tip of the leaf are green. The next step, when the tip yellows, is soon followed by the fall of the affected leaf. A typical progressive series of symptoms is shown in Fig. 2.

The premature defoliation of trees affected by magnesium deficiency is a typical characteristic. It is found that when the deficiency occurs severely on young apple trees, at the end of the growing season only a few leaves on the tip of each leader remain, the rest having fallen off during the season.

CONTROL MEASURES

In other parts of the world where magnesium deficiency is a problem in orchards, a satisfactory method of control is to treat the soil with large quantities of magnesium-containing minerals. Dolomitic limestone, a naturally occurring mixture of calcium carbonate and magnesium carbonate, is often used. Under soil management systems usually followed in orchards in Western Australia, many fertilisers applied to the soil are not readily taken up by the trees. This has been a bar to successful treatment of magnesium deficiency with soil applications in Western Australia. Apples and oranges have been treated with heavy amounts of magnesium-containing fertilisers in a number of cases, but usually control of the deficiency has been unsatisfactory.

There is available in Western Australia a suitable magnesium containing mineral known as magnesite. Its use as a soil treatment for magnesium deficiency could only be recommended however, where conditions were favourable for it to penetrate the soil and be taken up by the tree. These favourable circumstances include adequate summer irrigation and also acid soil conditions.

Where long term control of magnesium deficiency with soil applications cannot be achieved, leaf sprays of magnesium sulphate are recommended to control the deficiency. Even when soil treatment is used, sprays may have to be used for a few years until the soil treatment exerts its influence. Unfortunately, such sprays have to be applied each year as they have little or no residual effect. As magnesium deficiency is so closely related to cropping it is advisable with both apples and oranges suspected of suffering from this deficiency to spray trees whenever they are carrying a heavy crop. The concentration of spray used is 2 per cent. Epsom Salts (magnesium sulphate). Such a spray is made up with 20 lb. of Epsom Salts to 100 gallons of water. This spray is improved by adding a suitable wetting agent. The same concentration is used for both apples and oranges. Apples should be sprayed one or more times in November or December depending on the severity of the deficiency; up to three sprays may be needed. Oranges can be sprayed at any time of the year that there is sufficient new growth on the tree to effectively absorb the magnesium. Autumn spraying is generally recommended, as the deficiency is usually most severe at this season.

ACKNOWLEDGMENT

Acknowledgment is made to Dr. T. C. Dunne for the colour photos which are used to illustrate the deficiency symptoms in this article.

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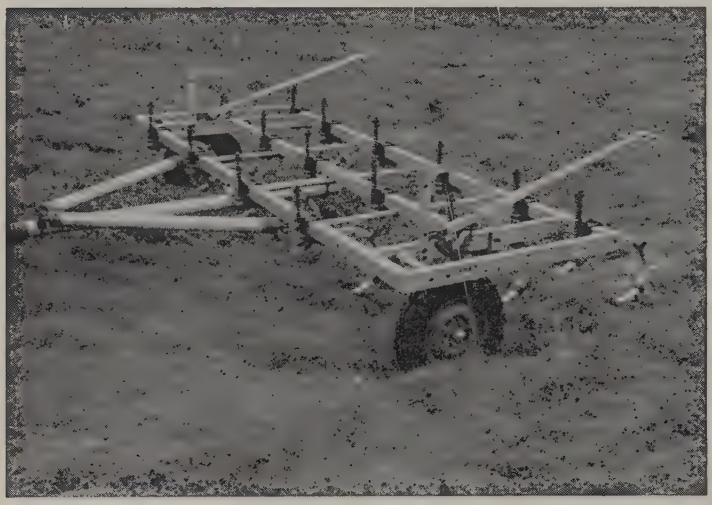

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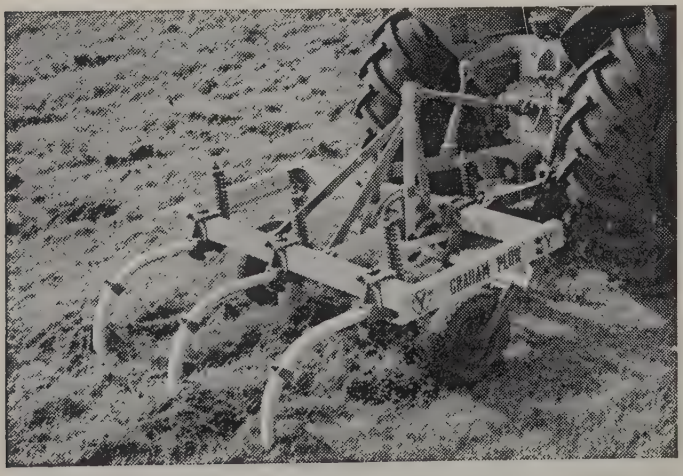

At left: Model E5' Linkage Plow.

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THE COLLECTION AND PRESERVATION OF INSECTS

By L. E. KOCH, B.Sc., Entomologist

INSECTS may be collected with the aid of a collecting-net or a suction-tube and killed in an appropriate bottle containing a killing agent. The insects are then pinned and mounted on a spreading-board. When the specimens are dry they are removed from the board, suitably labelled, and put away in a store box. Certain insects which cannot be mounted immediately after collection are relaxed in moist jars. Larval and pupal stages are stored in labelled tubes containing alcohol.

The collection of insects ranks among the best of hobbies and also forms a necessary adjunct to most branches of professional entomology. An insect specimen represents a species which, to the more serious hobbyist and professional entomologist, will need to be properly identified. Insects should be prepared in the approved manner to display their taxonomic characters to best advantage and they should bear adequate labels.

The instructions in this article by no means represent a full coverage of all the collecting, preparing and preserving methods but they should help to serve as a useful guide to some of the more popular and fundamental techniques used for all but the smallest insects.

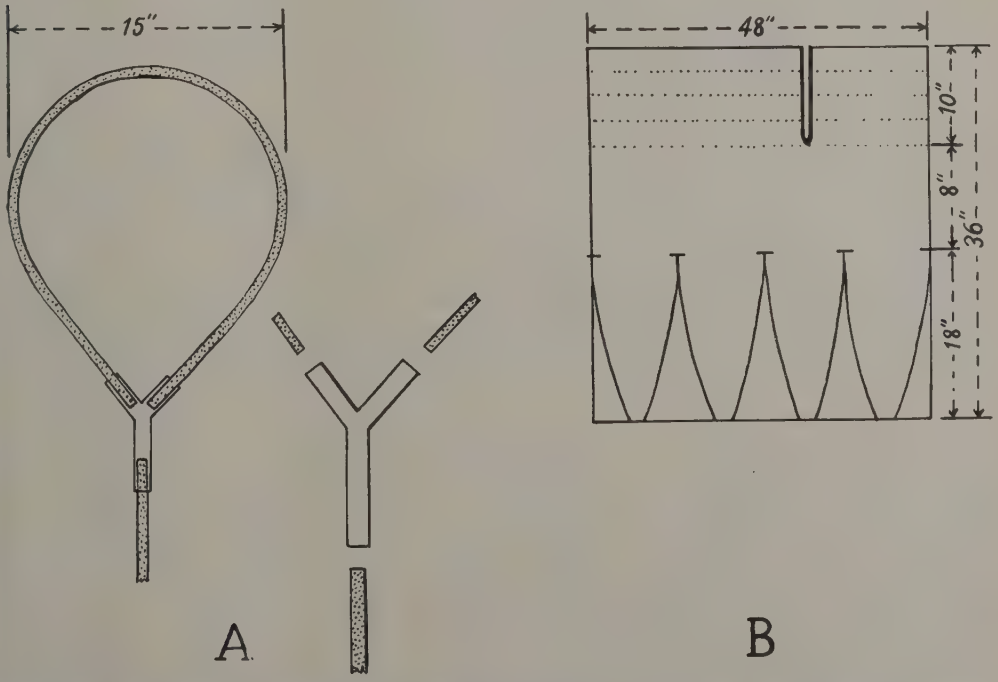

Fig. 1.—The construction of a collecting net. (A) How to join the cane loop and the handle by means of a Y-shaped piece of metal made by soldering together three pieces of metal tube. (B) How to cut a single piece of cloth to make a net

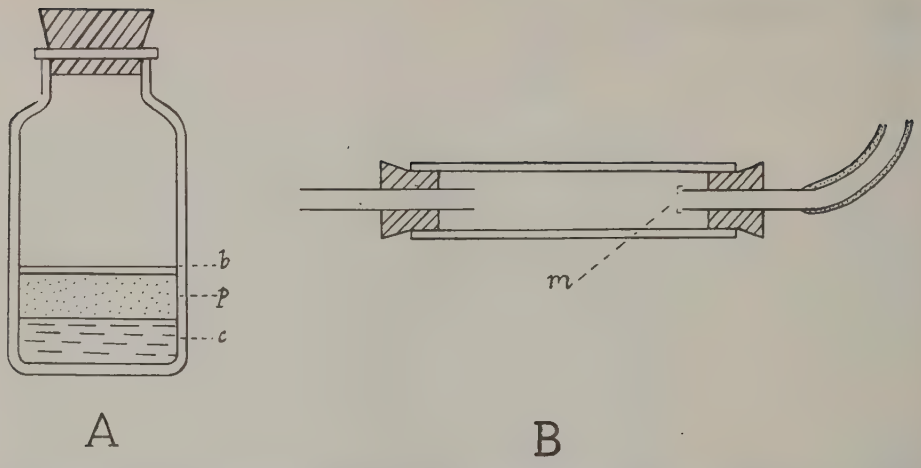

Fig. 2.—(A) A killing bottle. b,—blotting paper; p,—plaster of paris; c,—cyanide. (B) An aspirator or suction-tube. The left-hand end of the apparatus is placed near the small insects and suction is applied at the end of the rubber tube on the right-hand side. m,—piece of muslin or bolting-cloth which is fastened over the end of the tube to prevent the insects from being sucked into the mouth of the operator

COLLECTING NET

A simple frame for a collecting net can be made by bending one-eighth inch iron or steel wire or cane to form a loop of about 15 inches in diameter and fixing the straight ends firmly to a handle. A handle should be both strong and light and one about two or three feet long may be found most convenient.

The method of making the net bag is shown in Fig. 1B. The opening of the net where it is attached to the ring should be reinforced with a strong cloth such as light canvas, heavy muslin or linen, in the form of a tube about two inches in diameter. This should help to increase the life of the net because most wear takes place around the rim.

SUCTION-TUBE OR ASPIRATOR

This piece of apparatus (Fig. 2B) is used to collect small insects: to catch them rapidly, to pick individual insects from an assortment, or to collect them off plant material.

KILLING AGENTS

The most satisfactory killing agent is cyanide. This may be used either in the form of calcium cyanide, calcium cyanamide, sodium cyanide, or best as potassium cyanide.

Many liquids have vapours which kill insects. Some of the liquids commonly used are acetic ether (contained in nail polish remover), tetrachlorethane, carbon tetrachloride, ether, benzene, chloroform,

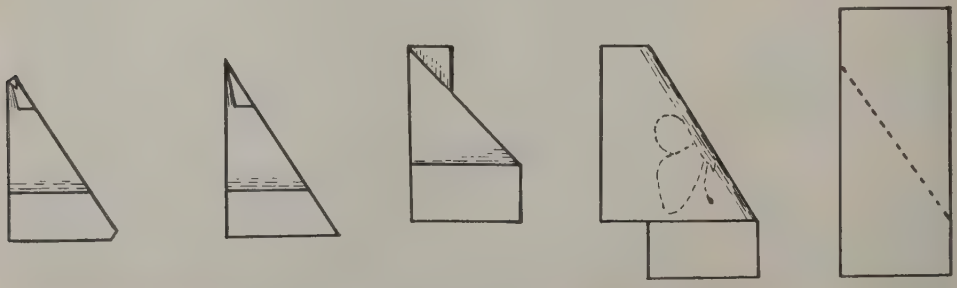

Fig. 3.—Method of making envelopes for storing insects

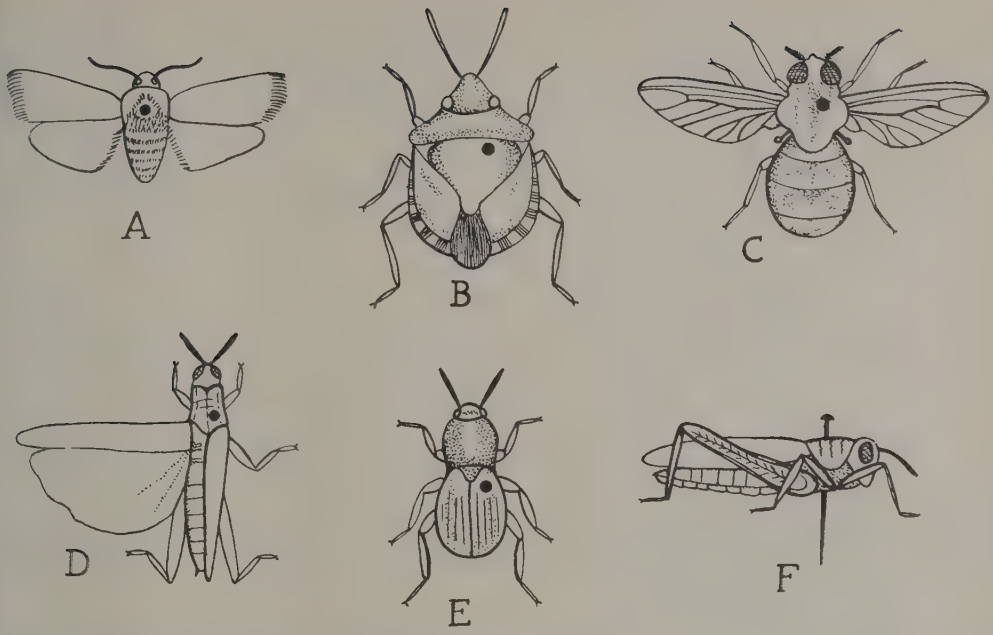

Fig. 4.—Examples of where the pin should be inserted for various orders of insects. The black dot indicates the position of the pin. (A) Moths and butterflies, order *Lepidoptera*; (B) Bugs, order *Hemiptera*; (C) Flies, order *Diptera;* (D) Grasshoppers and related *Orthoptera.* Note that in this order only the left-hand wings are spread; (E) Beetles, and weevils, *Coleoptera;* (F) Grasshopper, side view.

ammonia, and petrol. Many of these poisons are inflammable.

These liquids are best used by pouring a few drops on absorbent material which is in the bottom of a suitable bottle. It is a good plan to put a few layers of blotting paper over the absorbent material to prevent the insects from coming into direct contact with the liquid.

WARNING.—Cyanide is a deadly poison and must be used only in a specially prepared killing bottle such as the one described below. The killing bottle must be labelled as such, and old bottles that are no longer required must be burnt in a furnace or buried. If a killing bottle should break, the broken pieces must be handled very carefully and they should all be burnt or buried.

PAPER ENVELOPES

Butterflies, moths, and dragonflies. which have large wings and relatively small bodies, may be stored in triangular paper envelopes if mounting immediately after killing is impractical. Dragonflies should be folded alive in the envelopes and left to die. This is necessary because killing agents cause dragonflies to lose their beautiful colours. The insect's wings are folded over its back and only one specimen is put in each envelope. Stiff paper is generally used for making the envelope. Fig. 3 shows how the paper is folded. Information about the species being stored should be written on the envelope before the specimen is inserted.

RELAXING

Specimens that are to be mounted dry must be in a relaxed condition while being mounted. They must be sufficiently relaxed to enable the body and appendages to be easily movable so that they can be arranged as required on the mounting board. It is best, whenever possible, to mount all insects soon after they have been killed, before they have become dry and stiff. Large insects normally take longer to stiffen than small ones and the

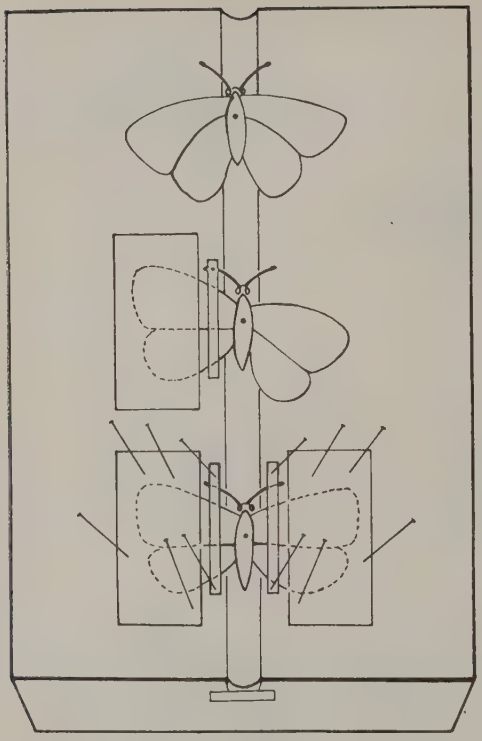

Fig. 5.—How to set an insect on a spreading board

stiffening may be delayed considerably if the insects are kept in an ethyl acetate killing bottle.

Specimens that are dry and stiff are relaxed by placing them in a relaxing jar. This is a large container which has a layer of sand or other suitable absorbent material saturated with water. To the absorbent layer is also added a small quantity of naphthalene, paradichlorobenzene, phenol, or ethyl acetate to prevent the formation of mould. A layer of blotting paper on the absorbent layer prevents the insects from coming into direct contact with the water.

PINNING

The pin is inserted directly through the body of the insect. Special entomological pins must always be used for mounting insects and the insect is pinned with the thickest size of pin it will take without significant damage to the insect. The pin should be applied at the correct point in the body and this point depends on the order to which the insect belongs. In Fig. 4, the position of the pin for insects belonging to some of the common orders is indicated. The insect is mounted at the correct height ($\frac{3}{8}$ in.) below the pin head and must not be tilted on the pin.

SPREADING

A spreading board consists of two flat, parallel pieces of soft-wood, covered with smooth paper with a cork-lined groove between their inner edges. Most collectors have an assortment of boards of various sizes. The particular board chosen depends upon the wingspan and the width of the abdomen of the insect being mounted. The spreading of insects is easy in principle but requires much practice before it can be done easily and neatly. Fig. 5 shows how the spreading is done. The strips of paper, cellophane or tracing cloth are secured by pins so placed that they do not pass through the wings. The antennae and legs are arranged symmetrically and held in position with pins. If the abdomen shows a tendency to drop, it is supported by pins crossed beneath it. The data for each insect is written on a label and pinned to the board beside the specimen.

The spreading board is placed in a dry, dust-free, airy place until the insects on it have dried. The insects are usually

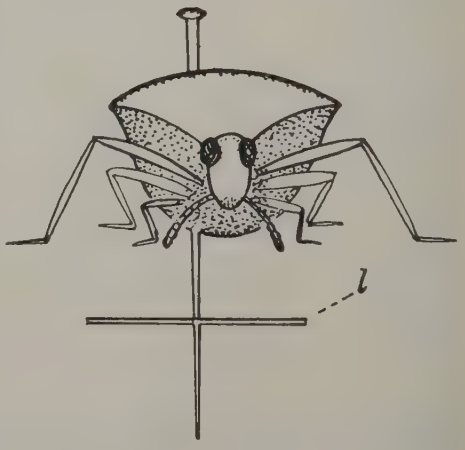

Fig. 6.—Front view of an insect showing position of the label (l)

thoroughly dry in about three weeks but the time taken can vary and depends on the size of the insects and the prevailing conditions of temperature and humidity. It is better to leave insects overlong on the spreading boards, rather than to risk taking them off too soon because if this is done the wings, legs and antennae may droop. In removing insects from the boards care should be taken not to break the antennae or legs.

LABELLING

Adequate labelling is very important. The labels of good quality stiff paper, are transfixed by the pin of the appropriate specimen. The information should be clearly written and should include the exact locality of capture, the date of capture and the name of the collector and preferably also the name of the host plant and the type of habitat. Figure 6 shows the position of the label.

STORE BOX

Special boxes are available for the storage of insects. However, insects may be stored in any wooden or cardboard box or bottle deep enough to take pins. Cigar boxes are satisfactory. The best substance for the bottom of the container is a layer of compressed cork of sufficient thickness to enable the pinned specimen to be held firmly in place. A small amount of pest-proofing substance such as camphor, naphthalene, or paradichlorobenzene should be placed in the container. A tight-fitting lid should be used to keep the container free of dust. Most specimens fade if exposed to light for any length of time so care must be taken, especially in the case of containers made of glass, to store the specimens in a dark place.

PRESERVATION OF IMMATURE STAGES

The larval and pupal stages of insects are stored in 70-80 per cent. alcohol, after they have been killed by dropping them for a few seconds into boiling water. These specimens are stored in glass tubes having rubber or plastic stoppers. A label giving information, including date and locality of capture, is written with black Indian ink (if unavailable, use pencil) on a piece of white card of suitable size and placed in the tube with the specimen.

ACKNOWLEDGMENT

Thanks are due to Mr. C. F. H. Jenkins, Government Entomologist, for advice and direction in the preparation of this article.

GOVERNMENT VETERINARIAN FOR ALBANY

Mr. J. M. Armstrong, B.V.Sc., of the Animal Division of the Department of Agriculture has been appointed to the Albany District Office of the Department.

In announcing this appointment, the Minister for Agriculture (Mr. C. D. Nalder), said that this was in pursuance of the Department's policy of stationing veterinarians at key centres for the control of infectious livestock diseases and to investigate and advise upon animal health problems. He said however that it should be clearly understood that it was not the Department's function to provide a practitioner service for the treatment of individual cases of sickness in farm animals.

The Minister said that the Department now has veterinary officers at Albany, Bunbury and Geraldton in addition to those operating from the metropolitan area.

Mr. Armstrong is a West Australian and was the first veterinarian to qualify under the Department's cadetship scheme inaugurated in 1949. He graduated with honours at the Sydney University Veterinary School and spent some years as veterinary pathologist at the Animal Health and Nutrition Laboratories, Hollywood. His personal preference was for veterinary work in the field however, and the recent appointment of an American veterinary scientist, Dr. M. R. Gardiner, to the position of Senior Veterinary Pathologist at the Animal Health and Nutrition Laboratories, made it possible to release him for duty in the Lower Great Southern district.

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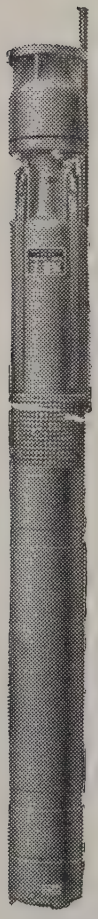

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A Revised List of Vegetable Diseases Recorded in Western Australia

Compiled from Departmental Records by S. C. CHAMBERS, M.Sc., Plant Pathologist

THIS list of vegetable diseases constitutes a revision of portion of the census published by Carne (1925) and added to by the same author in 1927. It contains also records of diseases identified in the period between these earlier publications and December 31, 1957.

The list is arranged alphabetically according to the botanical names of the host plants. In general, the viral, bacterial, fungal and nematodal diseases and physiological disorders of each host are listed in that order. The locality and date of the first record in each instance is also given whenever possible.

A list of common names of host plants has been appended to facilitate reference.

Host	Cause	Common Name	FIRST RECORD		
			Place	Month	Year
Allium ascalonicum L. (SHALLOT)	*Peronospora destructor* (Berk.) Casp.	Downy Mildew	Albany	August	1949
	Pyrenochaeta terrestris (Hansen) Gorenz, Walker & Larsen	Red Root / Pink Root	....	November	1932
	Pathogen Not Recorded	Storage Rot	Kronkup	May	1955
Allium cepa L. (ONION)	Pathogen Not Recorded	Bacterial Disease	....	August	1918
	Pathogen Not Recorded	Bacterial Rot of Leaves	Mt. Lawley	October	1926
	Aspergillus niger v. Teigh.	Black Mould	Glen Forest	....	1934-35
	Collectotrichum circinans (Berk.) Vogl.	Smudge	Spearwood	February	1931
	Fusarium sp.	Bulb Rot	Peel Estate	August	1924
	Peronospora destructor (Berk.) Casp.	Downy Mildew	....	....	1919
	**Pyrenochaeta terrestris* (Hansen) Gorenz, Walker & Larsen.	Red Root / Pink Root	Spearwood	May	1919
	†*Meliodogyne sp.*	Leaf Mould	....	November	1918
	Non Parasitic	Root Knot Eelworm	....	....	1919
	Pathogen Not Recorded	Sun Scald	Metropolitan	January	1955
		Storage Rot	Dunsborough	May	1955
Apium graveolens L. (CELERY)	? Virus	Witch's Broom	Balcatta	July	1955
	? *Erwinia caratovora* (Jones) Holland	Bacterial Soft Rot	Kenwick	June	1956
	Cercospora apii Fres.	Early Blight / Leaf Blight	Perth	....	1935
	Sclerotinia ? *sclerotiorum* (Lib.) de By	Sclerotinia Rot	Osborne Park	September	1957
	Septoria apii (Briosi & Cav.) Chester	Late Blight / Leaf Spot	Osborne Park	....	1923
	Meloidogyne javanica (Treub) Chitwood	Root Knot Eelworm	Osborne Park	April	1956
	Non Parasitic	Pithiness	Osborne Park	September	1957
Beta vulgaris L. (RED BEET)	*Streptomyces scabies* (Thaxt.) Waks & Henrici	Common Scab	....	January	1954
	? *Fusarium sp.*	Root Rot	Middle Swan	March	1955
	Sclerotinia sp.	Sclerotinia Rot	Greenmount	November	1955
	Uromyces betae (Pers.) Lev.	Rust	Fremantle	October	1924
	Heterodera schachtii A. Schmidt	Sugar Beet Eelworm	....	....	1932-33
	‡*Meloidogyne javanica* (Treub) Chitwood	Root Knot Eelworm	....	....	1919
Beta vulgaris L. var. *cicla* L. (SILVER BEET)	§*Cucumber Mosaic Virus*	Mosaic	Osborne Park	October	1945
	Cercospora beticola Sacc.	Leaf Spot	Balcatta	....	1943
	Rhizoctonia sp.	Crown and Root Rot	Cottesloe	January	1955
	Uromyces betae (Pers.) Lev.	Rust	Osborne Park	August	1957
	‡*Meloidogyne javanica* (Treub) Chitwood	Root Knot Eelworm	Metropolitan	....	1944
Beta vulgaris L. var. *macrorrhiza* (SUGAR BEET OR MANGEL)	? *Cercospora beticola* Sacc.	Leaf Spot	Boyanup	July	1923
	Uromyces betae (Pers.) Lev.	Rust	Fremantle	October	1924
	Pathogen Not Recorded	Damping Off	Albany	December	1925

* Correct Identity Established, July, 1930.

† Recorded as *Heterodera radicicola* (Greef) Mull.

‡ Identified 1955. Previously Recorded as *Heterodera radicicola* (Greef) Mull.

§ Confirmed 1955.

Vegetable Diseases—*continued.*

Host	Cause	Common Name	FIRST RECORD		
			Place	Month	Year
Brassica napobrassica Mill (SWEDE)	*Xanthomonas campestris* (Pam.) Dows.	Black Rot	Lower Chittering	September	1947
	Albugo candida (Pers. ex Chev.) Kuntze	White Rust	Metropolitan	....	1940
	Cercospora albo-maculans Ell. & Ev.	White Leaf Spot	Bullsbrook	....	1933-34
	Cercosporella sp.	....	Byford	May	1947
	Phoma lingam (Tode ex. Fr.) Desm.	Black Leg / Dry Rot	Bullsbrook	November	1956
	Phyllosticta sp.	....	Wooroloo	July	1956
	Non Parasitic	Internal Cork	Pickering Brook	....	1934-35
Brassica oleracea L. var. *acephala* D.C. (KALE)	*Phoma lingam* (Tode ex. Fr.) Desm.	Black Leg	Bluff Point	....	1936-37
Brassica oleracea L. var. *botrytis* CAULIFLOWER)	*Cauliflower Mosaic Virus*	Mosaic	Nedlands	....	1943
	? *Erwinia carotovora* (Jones) Holland	Bacterial Soft Rot	Spearwood	May	1955
	Pseudomonas maculicola (McCull.) Stevens	Bacterial Leaf Spot / McCulloch's Leaf Spot	Katanning	August	1931
	Xanthomonas campestris (Pam.) Dows.	Black Rot	Coogee	April	1924
	Alternaria brassicae (Berk.) Sacc.	Leaf Spot	Balcatta	....	1952
	Cephalothecium roseum Cda.	Pink Mould	Capel	November	1925
	Mycosphaerella brassiciola (Fr. ex Duby) Lindau	Ring Spot	Boyanup	July	1923
	Pellicularia filamentosa (Pat.) Rogers.	Damping Off / Wire Stem	Osborne Park	March	1947
	Peronospora parasitica (Pers.) ex Fr.	Downy Mildew	Gingin	....	1935-36
	Phoma lingam (Tode ex. Fr.) Desm.	Black Leg	Coogee	April	1924
	Phyllosticta sp.	Curd and Leaf Spot	Bullsbrook	June	1956
	Plasmodiophora brassicae Woron.	Club Root	Albany	March	1943
	Sclerotinia sclerotiorum (Lib.) de By.	Sclerotinia Rot	West Swan	August	1941
	Heterodera schachtii A. Schmidt.	Sugar Beet Eelworm	Spearwood	April	1957
	Non Parasitic	Oedema	Belmont	August	1925
	Non Parasitic	Frost Injury	Balcatta	September	1957
Brassica oleracea L. var. *capitata* L. (CABBAGE)	? *Erwinia carotovora* (Jones) Holland	Bacterial Soft Rot	Osborne Park	January	1944
	Pseudomonas maculicola (McCull.) Stevens	Bacterial Leaf Spot / McCulloch's Leaf Spot	....	....	1930
	Xanthomonas campestris (Pam.) Dows.	Black Rot	....	....	1921
	Mycosphaerella brassicicola (Fr. ex Duby) Lindau	Ring Spot	Boyanup	July	1923
	Pellicularia filamentosa (Pat.) Rogers	Damping Off / Wire Stem	Balcatta	January	1957
	Peronospora parasitica (Pers.) ex Fr.	Downy Mildew	Wanneroo	July	1945
	Phoma lingam (Tode ex. Fr.) Desm.	Black Leg	Coogee	April	1924
	Plasmodiophora brassicae Woron.	Club Root	....	....	1918
	Sclerotinia sclerotiorum (Lib.) de By.	Sclerotinia Rot	....	May	1955
	Heterodera schachtii A. Schmidt.	Sugar Beet Eelworm	Spearwood	April	1925
	**Meloidogyne sp.*	Root Knot Eelworm	Fremantle	December	1919
	Non Parasitic	Oedema	Gosnells	September	1928
Brassica oleracea L. var. *gemmifera* Zenker (BRUSSELS SPROUTS)	*Cabbage Black Ringspot Virus* Smith	Black Ringspot Virus	Bedfordale	....	1956
	Pseudomonas ? syringae Van Hall	....	Bedfordale	....	1955
	Xanthomonas campestris (Pam.) Dows.	Black Rot	....	....	1955
	Botrytis cinerea Fr.	Grey Mould	Bedfordale	August	1956
	Plasmodiophora brassicae Woron.	Club Root	Bedfordale	June	1949
	Sclerotinia sclerotiorum (Lib.) de By.	Sclerotinia Rot	Bedfordale	February	1946
Brassica rapa L. (TURNIP)	*Xanthomonas campestris* (Pam.) Dows.	Black Rot	Bayswater	May	1956
	Albugo candida (Pers. ex Chev.) Kuntze	White Rust	Metropolitan	....	1940
	? *Cercospora albo maculans* Ell. & Ev.	White Leaf Spot	Wooroloo	July	1956
	Plasmodiophora brassicae Woron.	Club Root	....	....	1921
	**Meloidogyne sp.*	Root Knot Eelworm	Perth Market	December	1919
	Non Parasitic	Internal Cork	Pickering Brook	....	1934-35
Capsicum annuum L. (PEPPER)	Non Parasitic	Heat Injury	Carnarvon	January	1956
Citrullus vulgaris Schrad. (WATER MELON)	*Fusarium oxysporum f niveum* (E.F. Sm) Snyder & Hansen	Fusarium Wilt	Maylands	January	1926
	Non Parasitic	Heat Injury to Fruit	Scarborough	January	1955
Cucumis melo L. (ROCK MELON OR CANTALOUP)	*Cucumber Mosaic Virus*	Mosaic	Balcatta	October	1952
	Erysiphe cichoraceurum DC.	Powdery Mildew	Mt. Helena	February	1955
	Pellicularia rolfsii (Curzi) West.	Fruit Rot	Cannington	February	1949
	Meloidogyne sp.	Root Knot Eelworm	Mt. Lawley	January	1957
	Non Parasitic	Non Setting of Fruit	Mt. Lawley	November	1930
Cucumis sativus L. (CUCUMBER)	*Cucumber Mosaic Virus*	Mosaic	Balcatta	October	1952
	Pseudomonas lachrymans (E.F. Sm. & Bryan) Carsner	Angular Leaf Spot	Balcatta	May	1956
	†*Erysiphe cichoracearum* DC.	Powdery Mildew	Byford	....	1931-32
	Fusarium sp.	Fusarium Wilt	Wooroloo	January	1955
	‡*Meloidogyne javanica* (Treub) Chitwood	Root Knot Eelworm	Carnarvon	July	1928
	Cause Unknown	Fasciation	Fremantle	December	1957

* Recorded as *Heterodera radicicola* (Greef) Mull.

† Identified 1956, Previously Recorded as *Oidium sp.*

‡ Identified 1956, Previously Recorded as *Heterodera radicicola* (Greef) Mull.

Host	Cause	Common Name	FIRST RECORD		
			Place	Month	Year
Cucurbita moschata Dene. (VEGETABLE MARROW)	*Cucumber Mosaic Virus*	Mosaic	Perth	....	1953
	Botrytis cinerea Fr.	Grey Mould	Osborne Park	October	1955
	Erysiphe cichoracearum DC.	Powdery Mildew	South Perth	February	1925
	Non Parasitic	Non Setting of Fruit	Como	November	1930
Curcurbita pepo L. (PUMPKIN)	*Erysiphe cichoracearum* DC.	Powdery Mildew	Osborne Park	....	1923
	Fusarium sp.	Root Rot	Herne Hill	January	1931
	Meloidogyne sp.	Root Knot Eelworm	Metropolitan	February	1957
	Non Parasitic	Non Setting of Fruit	Serpentine	February	1955
	Non Parasitic	Heat Injury	....	January	1956
Daucus carota L. (CARROT)	*Carrot Motley Dwarf Virus*	Motley Dwarf	Osborne Park	July	1944
	?*Erwinia carotovora* (Jones) Holland	Bacterial Soft Rot	Osborne Park	November	1955
	?*Xanthomonas carotae* (Kendr.) Dows.	Bacterial Blight	Osborne Park	June	1957
	Alternaria radicina Meier, Drechsler & Eddy	Black Rot	Balcatta	....	1943
	**Cercospora sp.*	Leaf Spot	....	?February	1944
	Fusarium sp.	Fusarium Rot	Osborne Park	June	1957
	†*Meloidogyne javanica* (Treub) Chitwood	Root Knot Eelworm	Palmyra	August	1921
Ipomoea batatas (L) Lam (SWEET POTATO)	*Monilochaetes infuscans* Ell. & Halst. ex Harter	Scurf	Herdsman's Lake	March	1945
Lactuca sativa L (LETTUCE)	*Lettuce Mosaic Virus*	Lettuce Mosaic	Balcatta	July	1952
	Tomato Spotted Wilt Virus Samuel Bald & Pittman	Spotted Wilt	Kalgoorlie	....	1937-38
	?*Erwinia carotovora* (Jones) Holland	Bacterial Soft Rot	Perth	December	1925
	Botrytis cinerea Fr.	Grey Mould	Arrino	August	1926
	Bremia lactucae Reg.	Downy Mildew	Spearwood	August	1934
	Pellicularia filamentosa (Pat.) Rogers	Bottom Rot / Damping Off	Osborne Park	March	1949
	Pythium sp.	Pythium Stunt / Damping Off	Osborne Park	October	1947
	Sclerotinia minor Jagger	Drop / Sclerotinia Rot	Busselton	March	1955
	Sclerotinia sclerotiorum (Lib.) de By.	Drop / Sclerotinia Rot	Busselton	May	1955
	Septoria lactucae Pass.	Septoria Leaf Spot	Fremantle	December	1950
	Stemphylium botryosum Wallr.	Leaf Spot	Balcatta	June	1954
	¶*Meloidogyne javanica* (Treub) Chitwood	Root Knot Eelworm	....	....	1932-33
	Non Parasitic	Frost Injury	Balcatta	June	1954
	Non Parasitic	Tip Burn	Maida Vale	March	1929
Lycopersicon esculentum Mill (TOMATO)	*Cucumber Mosaic Virus*	Fern Leaf	Guildford	June	1952
	Tobacco Mosaic Virus, Clinton	Ordinary or Mild Tomato Mosaic	Geraldton	May	1953
	Tobacco Mosaic Virus, Tomato Aucuba Mosaic Virus Strain	Aucuba Mosaic	Geraldton	May	1957
	Tobacco Mosaic Virus, Tomato Streak Virus Strain	Streak	Geraldton	June	1928
	Tomato Big Bud Virus Samuel Bald & Eardley	Big Bud	Bullsbrook	February	1926
	‡*Tomato Spotted Wilt Virus*, Samuel Bald & Pittman	Spotted Wilt	....	....	1923
	Corynebacterium michiganense (E.F. Sm.) Jensen	Bacterial Canker	Wanneroo	December	1945
	Pseudomonas solanacearum E.F. Sm.	Bacterial Wilt	Wanneroo	February	1925
	Xanthomonas vesicatoria (Doidge) Dows.	Bacterial Spot	Metropolitan	....	1947
	Alternaria solani (Ell. & Mart.) Jones & Grout	Target Spot / Early Blight	....	....	1911
	Alternaria tomato (Cke.) G. F. Weber	Nailhead Spot	Geraldton	August	1948
	Botrytis cinerea Fr.	Grey Mould	Geraldton	September	1954
	Fusarium oxysporum F. lycopersici (Sacc.) Snyder & Hansen	Fusarium Wilt	....	....	1923
	?*Macrophomina phaseoli* (Maub.) Ashby	Ashy Stem Blight	Geraldton	July	1930
	?*Oospora sp.*	....	....	October	1924
	Pellicularia filamentosa (Pat.) Rogers	Rhizoctonia Stem Canker	Geraldton	....	1931
	Pellicularia rolfsii (Curzi) West	Southern Blight	Perth	March	1955
	Penicillium sp.	Penicillium Fruit Rot	Geraldton	October	1952
	Phoma destructiva Plowr.	Phoma Rot	Geraldton	June	1935
	Phytophthora ? parasitica Dast.	Buck Eye Rot	Carnarvon	....	1947
	Phytophthora sp.	Collar Rot	Osborne Park	September	1941
	§ *Pleospora lycopersici* El. & Em. Marchal.	Pleospora Fruit Rot	Geraldton	September	1941
	Rhizopus sp.	Rhizopus Soft Rot	Geraldton	September	1948
	Sclerotinia minor Jagger	Stem Rot	Geraldton	September	1949
	Sclerotinia sclerotiorum (Lib.) de By.	Stem Rot	Geraldton	October	1929
	Septoria lycopersici Speg.	Septoria Leaf Spot	West Leederville	August	1925
	‖ *Verticillium dahliae* Kleb.	Verticillium Wilt	? Bullsbrook	February	1926
	Verticillium ? albo-atrum Reinke & Berth.	Verticillium Wilt	Geraldton	November	1949
	†*Meloidogyne javanica* (Treub) Chitwood	Root Knot Eelworm	Fremantle	June	1916
	Non-Parasitic	Blossom End Rot	Busselton	March	1925
	Non-Parasitic	Blotchy Ripening	Geraldton	....	1938-39

* Confirmed Osborne Park April, 1955.
† Identified 1955, Previously recorded as *Heterodera radicicola* (Greef) Mull.
‡ Identified 1934, Previously Recorded as Spotted Wilt (Cause Unknown).
§ Identified 1952, Previously Recorded as *Stemphylium sp.*
‖ Confirmed Balcatta, 1950.
¶ Identified 1958, Previously Recorded as *Heterodera radicicola* (Greef) Mull.

Host	Cause	Common Name	FIRST RECORD		
			Place	Month	Year
Lycopersicon esculentum Mill (TOMATO)—*contd.*	Non-Parasitic	Cracking of Fruit	Forrestfield	March	1931
	Non-Parasitic	Leaf Roll	....	January	1955
	Non-Parasitic	Non Setting of Fruit	Harvey	January	1929
	Non-Parasitic	Sectorial Chimera	Geraldton	September	1929
	Non-Parasitic	Sun Scald of Fruit	....	....	1924-25
	Pathogen Not Recorded	Damping Off	Coogee	June	1955
Pastinaca sativa L. (PARSNIP)	*Phyllachora pastinacae* (West.) Rostr.	Phyllachora Leaf Spot	Spearwood	July	1934
	‖ *Meloidogyne javanica* (Treub) Chitwood	Root Knot Eelworm	Osborne Park	April	1916
	Cause Unknown	Root Bronzing	Osborne Park	November	1957
Petroselinum hortense Hoffm (PARSLEY)	*Meloidogyne sp.*	Root Knot Eelworm	City Beach	February	1955
Phaseolus vulgaris L. (BUTTER, FRENCH, NAVY AND POLE BEAN)	*Bean Mosaic Virus* Stewart & Reddick	Common Bean Mosaic	Balcatta	....	1944
	Bean Yellow Mosaic Virus	Bean Yellow Mosaic	Balcatta	....	1954
	Pseudomonas phaseolicola (Burk.) Dows.	Halo Blight	Maddington	November	1930
	Xanthomonas phaseoli (E.F.S.) Dows.	Common Blight	Fremantle	September	1930
	Alternaria fasciculata (Cke. & Ell.) Jones & Grout	Leaf Spot	Balcatta	June	1945
	Ascochyta sp.	Ascochyta Pod Spot	....	July	1956
	Collectotrichum lindemuthianum (Sacc. & Magn.) Bri. & Cav.	Anthracnose	....	....	1901
	Fusarium solani f. phaseoli (Burk.) Snyder & Hansen	Fusarium Root Rot	....	March	1931
	Macrophomina phaseoli (Maub.) Ashby	Ashby Stem Blight	....	December	1925
	Pellicularia filamentosa (Pat.) Rogers	Collar Rot / Damping Off	Kelmscott	March	1941
	Pellicularia rolfsii (Curzi) West	Sclerotium Foot Rot	Gosnells	February	1926
	Pythium debaryamum Hesse.	....	Perth	June	1921
	Sclerotinia sclerotiorum (Lib.) de By.	Sclerotinia Disease	Perth	June	1928
	Uromyces phaseolorum De By.	Rust	Armadale	June	1929
	* *Meloidogyne javanica* (Treub.) Chitwood	Root Knot Eelworm	Fremantle	December	1917
	Genetic	Leaf Variegation	Nedlands	October	1945
	Non Parasitic	Heat Scorch	....	March	1930
	Non Parasitic	Non Setting of Beans	Wooroloo	February	1930
	Non Parasitic	Sun Scald	Denmark	February	1955
	Pathogen Not Recorded	Pre Emergence Damp-in Off	Helena Vale	January	1955
Pisum sativum L. (GARDEN PEA)	† *Pea Mosaic Virus* Doolittle & Jones	Pea Mosaic	? Geraldton	August	1929
	Tomato Spotted Wilt Virus Samuel, Bald & Pittman	Spotted Wilt	Pinjarra	....	1935-36
	Pseudomonas pisi Sackett	Bacterial Blight	Boyup Brook	....	1943
	Ascochyta pisi Lib.	Black Spot	Baker's Hill	September	1926
	Erysiphe polygoni DC. emend. Salm.	Powdery Mildew	Waroona	January	1932
	Fusarium ? solani f. pisi (F. R. Jones), Snyder & Hansen	Fusarium Root Rot	Jarrahdale	January	1926
	Fusarium ? oxysporum f. pisi (Linford), Snyder & Hansen	Fusarium Wilt	North Perth	October	1930
	Mycosphaerella pinodes (Berk. & Blox.) Stone	Leaf Spot	....	....	1914
	Mycosphaerella tulasnei (Jancz.) Lindau	Leaf Blotch	....	August	1918
	Pellicularia filamentosa (Pat.) Rogers	Rhizoctonia Root and Stem Rot	Osborne Park	March	1926
	Peronospora viciae (Berk.) Casp.	Downy Mildew	Beverley	October	1924
	Septoria pisi West.	Septoria Blotch	Pickering Brook	....	1935-36
	‡ *Meloidogyne sp.*	Root Knot Eelworm	Bayswater	September	1928
	Genetic	Leaf Variegation	Nedlands	....	1945
	Non Parasitic	Frost Injury	Metropolitan	June	1955
	Non Parasitic	Heat Injury	....	February	1930
	Non Parasitic	Non Setting of Peas	Metropolitan	January	1955
	Pathogen Not Recorded	Damping Off	Norseman	March	1944
	Pathogen Not Recorded	Stem Canker	Woodanilling	August	1927
Raphanus sativus L. (RADISH)	*Albugo candida* (Pers. ex Chev.) Kuntze	White Rust	Osborne Park	....	1944
	Plasmodiophora brassicae Woron.	Club Root	Perth	....	1931-32
Rheum rhoponticum L. (RHUBARB)	Pathogen Not Recorded	? Bacterial Root Rot	Claremont	February	1926
	Erwinia carotovora (Jones) Holland	Bacterial Soft Rot	Spearwood	March	1928
	Armillaria mellea (Vahl) Quel.	Root Rot	....	....	1919
	§ *Ascochyta rhei* Ell. & Ev.	Leaf Spot	....	October	1924
	Phytophthora sp.	Crown Rot	....	....	1924-25
	Puccinia phragmites (Schum.) Korn.	Rust	....	....	1918
	Ramularia ? rhei Allesch.	Ramularia Leaf Spot	Osborne Park	November	1957
	¶ *Meloidogyne javanica* (Treub) Chitwood	Root Knot Eelworm	Perth	June	1916
	Non Parasitic	Heat Injury	Leederville	January	1956

* Identified 1958. Previously recorded as *Heterodera radicicola* (Greef) Mull.

† Confirmed 1943.

‡ Recorded as *Heterodera radicicola* (Greef) Mull.

§ Identified 1954. Previously Recorded as *Phyllosticta sp.*

‖ Identified 1955. Previously Recorded as *Heterodera radicicola* (Greef) Mull.

¶ Identified 1946. Previously Recorded as *Heterodera radicicola* (Greef) Mull.

Host	Cause	Common Name	FIRST RECORD		
			Place	Month	Year
Solanum melongena L. (EGG PLANT)	? *Erwinia carotovora* (Jones) Holland	Bacterial Soft Rot	Carnarvon	January	1956
Solanum tuberosum L. (POTATO)	*Potato Leaf Roll Virus* Appel.	Leaf Roll	Denmark	April	1927
	Potato Purple Top Wilt Virus	Purple Top Wilt	Esperance	January	1956
	†*Potato Virus X*		? Pinjarra	September	1926
	Potato Virus Y	Streak	Gosnells	September	1928
	Potato Witch's Broom Virus Hungerford & Dana	Witch's Broom		May	1957
	‡*Tomato Spotted Wilt Virus* Samuel, Bald & Pittman	Spotted Wilt	? North Perth	October	1930
	Erwinia carotovora (Jones) Holland	Black Leg			1920
	Pseudomonas solanacearum E.F.Sm.	Bacterial Wilt			1920
	Streptomyces scabies (Thaxt.) Waks. & Henrici	Common Scab			1898
	Alternaria solani (Ell. & Mart.) Jones & Grout	Early Blight Target Spot Storage Disease			1920
	Armillaria mellea (Vahl) Quel.	Armillaria Tuber Rot			1924-25
	Fusarium sp.	Wilt Brown Ring			1920
	Fusarium sp.	Storage Rot			1924-25
	Helicobasidium purpureum (Tul.) Pat.	Violet Root Rot	Maddington		1931-32
	Pellicularia filamentosa (Pat.) Rogers	Rhizoctonia		June	1911
	Pellicularia rolfsii (Curzi) West	Southern Blight	Lowden	March	1956
	Phoma ? *tuberosa* Melh. Rosenb. & E. S. Schultz			June	1923
	Phytophthora erythroseptica Pethb.	Pink Rot	Harvey	June	1946
	Phytophthora infestans (Mont.) de By.	Late Blight Irish Blight	Guildford	August	1909
	Sclerotinia minor Jagger	Stem Canker			1932-33
	Sclerotinia sclerotiorum (Lib.) de By.	Stem Canker			1932-33
	Spondylocladium atrovirens Harz.	Silver Scurf			1923
	Spongospora subterranea (Wallr.) Lagerh.	Powdery Scab	Maylands		1949
	Stysanus stemonitis Cde.	Surface Mould	Hamel		1929
	Verticillium albo-atrum Reinke & Berth.	Vericillium Wilt	Dardanup		1932-33
	**Meloidogyne* ? *arenaria* (Neal) Chitwood **Meloidogyne* ? *incognita acrita* Chitwood	Root Knot Eelworm	Perth		1916
	Non Parasitic	Black Heart	Dwellingup	January	1930
	Non Parasitic	Brown Fleck			1920
	Non Parasitic	Enlarged Lenticels	Balcatta	November	1957
	Non Parasitic	Frost Injury		October	1929
	Non Parasitic	Injury from Tuber Dips	Bornholm	September	1928
	Non Parasitic	Growth Cracks	Spearwood	December	1957
	Non Parasitic	Hollow Heart			1920
	Non Parasitic	Spindling Sprout			1920
	Non Parasitic	Sun Scald	Zamia	December	1928
	Cause Unknown	Vascular Netting		May	1955
Soja max Piper (SOYA BEAN)	*Pseudomonas phaseolicola* (Burk.) Dows.	Halo Blight	Nedlands		1944
Vicia faba L. (BROAD OR TICK BEAN)	*Bean Yellow Mosaic Virus*	Bean Yellow Mosaic		May	1956
	Alternaria sp.	Alternaria Leaf Spot			1913
	Ascochyta fabae Speg.	Leaf Pod and Stem Spot	South Perth		1942
	§ *Botrytis cinerea* Fr.	Chocolate Spot Grey Mould	South Perth	October	1923
	Botrytis sp.	Leaf Pod and Stem Spot	Roleystone		1942
	Cercospora fabae Fautr.	Leaf Pod and Stem Spot	South Perth		1942
	Cladosporium sp.	Black Leaf Spot	South Perth	November	1923
	? *Phyllosticta sp.*	Black Leaf Spot	South Perth	August	1923
	Pythium ? *debaryanum* Hesse			July	1921
	Uromyces fabae (Pers.) de Bary	Broad Bean Rust		October	1921
	Meloidogyne sp.	Root Knot Eelworm	Middle Swan	August	1955
	Non Parasitic	Flower Blackening	Metropolitan	August	1955
	Non Parasitic	Flower Drop	South Belmont	August	1956
	Pathogen Not Recorded	Damping Off	Riverton	June	1957
	Pathogen Not Recorded	Root Rot	Middle Swan	August	1955
Zea mays L. var. *saccharata* (SWEET CORN)	Non Parasitic	Leaf Scorch	Osborne Park	February	1956
	Pathogen Not Recorded	Leaf Spot	Osborne Park	February	1956

* Identified 1958. Previously Recorded as *Heterodera radicicola* (Greef) Mull.

† Confirmed 1938.

‡ Confirmed 1937.

§ Identity established 1937–38.

APPENDIX

Common Names and Botanical Equivalents.

BEAN—
- Broad or Tick—*Vicia faba* L.
- Butter, French, Navy and Pole—*Phaseolus vulgaris* L.
- Soya—*Soja max* Piper.

BEET—
- Red—*Beta vulgaris* L.
- Silver—*Beta vulgaris* L. var. *cicla* L.
- Sugar—*Beta vulgaris* L. var. *macrorrhiza*

BRUSSELS SPROUTS—*Brassica oleracea* L. var. *gemmifera* Zenker.

CABBAGE—*Brassica oleracea* L. var. *capitata* L.

CANTALOUP—*Cucumis melo.* L.

CARROT—*Daucus carota* L.

CAULIFLOWER—*Brassica oleracea* L. var. *botrytis* L.

CELERY—*Apium graveolens* L.

CUCUMBER—*Cucumis sativus* L.

EGG-PLANT—*Solanum melongena* L.

KALE—*Brassica oleracea* L. var. *acephala* DC.

LETTUCE—*Lactuca sativa* L.

MANGEL—*Beta vulgaris* L. var. *macrorrhiza.*

MARROW—*Cucurbita moschata* Dcne.

MELON—
- Rock—*Cucumis melo* L.
- Water—*Citrullus vulgaris* Schrad.

ONION—*Allium cepa* L.

PARSLEY—*Petroselinum hortense* Hoffn.

PARSNIP—*Pastinaca sativa* L.

PEA—*Pisum sativum* L.

PEPPER—*Capsicum annuum* L.

POTATO—*Solanum tuberosum* L.

PUMPKIN—*Cucurbita pepo* L.

RADISH—*Raphanus sativus* L.

RHUBARB—*Rheum rhaponticum* L.

SHALLOT—*Allium ascalonicum* L.

SWEDE—*Brassica napobrassica* Mill.

SWEET CORN—*Zea mays* L. var. *saccharata.*

SWEET POTATO—*Ipomoea batatas* (L.) Lam.

TOMATO—*Lycopersicon esculentum* Mill.

TURNIP—*Brassica rapa* L.

ACKNOWLEDGMENT

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REFERENCES

Carne, W. M.—(1925). *J. Roy. Soc. W.A.* XI, 7; 43-68.

———————— (1927). *Ibid* XIV, 3; 23-28.

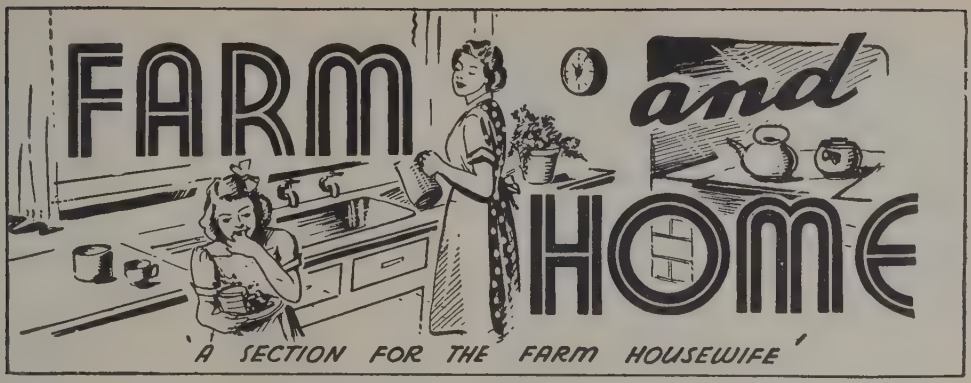
SHEEP-KILLERS DESTROYED

Agriculture Protection Board trapper, B. K. Davies, recently destroyed 12 wild dogs in the area between Mundaring Weir and York, and most of them had the typical characteristics of pure-bred dingoes.

Included in this total were three dogs, which were trapped following a complaint of dogs killing sheep on farms to the south-west of York. The three included two females carrying 13 pups, and the other was described by the trapper as the biggest dog he has ever seen. It was a black male which was operating on a wide travelling circuit on which Mr. Davies estimated to be a three week schedule.

Mr. Nalder said that the trapper set his trap, nominated a day, over a week later, on which the dog would return, and trapped it exactly on schedule.

It was considered that several of the wild dogs had moved north following extensive fires on forestry land to the south early in April and it was expected that there could be further movement into the area from the same direction.



Fish Pie

By HELEN M. GLOSTER

YOU will find this an excellent dish if you are short of meat. It may be used as the main course for lunch or dinner, and is also suitable for serving as a hot dish at a buffet dinner or supper.

Ingredients.

1 large tin West Australian salmon.
½ teaspoon salt and pepper to taste.
¼ teaspoon cayenne pepper or paprika.
¼ teaspoon mace.
½ grated lemon rind.
1 teaspoon lemon juice.
1 tablespoon chopped parsley.
1 tablespoon butter (for top of pie).
1½ tablespoon butter (for sauce).
2 tablespoons plain flour or cornflour.
4 tablespoons grated cheese.
1 pint liquid (milk plus liquid from salmon).
1 lb. cooked mashed potatoes.
Some dry breadcrumbs.

Method.

1. Cook and mash the potatoes.
2. Melt the butter (for sauce), add flour, stir until smooth.
3. Cook for several minutes until mixture has the appearance of honey comb.
4. Remove from fire and add liquid gradually.
5. Stir over the fire until mixture thickens and boils. Boil for three minutes.
6. Remove from fire and add seasonings, grated lemon rind and juice, parsley and salmon (well mashed and broken up into small pieces).
7. Add most of the grated cheese, mix well.
8. Place in a well-greased tin and cover with a layer of mashed potatoes.
9. Put knobs of butter on top then sprinkle with grated cheese and dry breadcrumbs.
10. Bake in a moderate oven until well heated and browned on top.
11. Serve hot.

N.B.—A 7½ in. square aluminium cake-tin is a suitably sized container for this quantity.

CHERRY BISCUITS

Ingredients.

¼ lb. butter or margarine.
2 oz. castor sugar.
1 egg.
¼ lb. plain flour.
¼ lb. self raising flour.
2 oz. crystallised cherries.
1 oz. blanched almonds.

Method.

1. Cream the butter and sugar.
2. Add well-beaten egg, beat until light and creamy.
3. Gradually stir in flour and when very stiff turn on to a board and knead together.
4. Roll out the dough.
5. Sprinkle with finely chopped cherries and almonds.
6. Fold the dough in two and roll out.

7. Fold once more and roll out to ¼ in. thickness (or less).

8. Cut into rounds and bake on a greased paper on a baking slide until a pale biscuit colour (about 10 minutes in a moderate oven).

A GARDENING HINT

Save short lengths of garden hose and thread with a slightly longer piece of fencing wire.

Use these when fixing shrubs to stakes.

FLORAL DECORATIONS

When arranging flowers, remove some of the leaves. All leaves below the water line should be removed. They take up too much room in the vase and tend to decompose quickly. Too many leaves left on a stem sometimes detract from the beauty of the bloom. Roses particularly, show to advantage if only one or two leaves are left on each stem.

A Coolie Sun-Hat

NEXT summer when you are making cotton frocks for the beach or informal outdoor wear, buy an extra half-yard of material and make this simple and useful coolie sun-hat.

The hat could be made of floral material and lined with a plain coloured material to match.

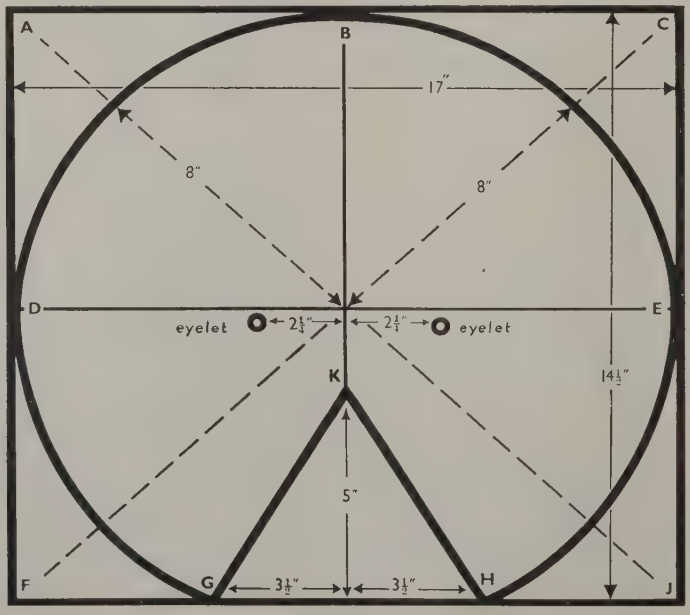
Materials Required.

½ yard floral washing cotton material.
½ yard plain matching cotton material.
½ yard stiffening (lantor, leno, sparterie or book muslin).
2 yards bias binding.
1½ yards circular cord.
2 eyelets.
1 press stud.
Brown paper.
Sewing cotton.

N.B.—A width of material 36 in. wide will make two hats.

Method.

1. Take a piece of paper measuring 17 in. x 14½ in., fold into four and mark out according to the diagram.



2. Mark out the curve for the brim.
3. Cut out two pieces of material and a layer of interlining from the pattern. If book muslin is used, you will require four thicknesses.

N.B.—The V is the only place where extra allowance must be made for turnings.

4. Place two pieces of material right sides together, then the stiffening on top.
5. Tack and sew along the V line (G to K and K to H).
6. Turn on to right side, press flat with iron.
7. Bind the edges with bias binding.
8. Insert or work two eyelets 2¼ in. from centre point and just below the centre line.

N.B.—Shoe eyelets may be put on at any bootmakers.

9. Sew on press stud by G and H points.
10. Thread with cord for tying under the chin.

Shopping Bag in Coloured String

THIS attractive and useful shopping bag was crocheted in coloured string using red, green, yellow and blue with nigger brown as the background colour.

Materials required are 11 1-ounce balls of string or macrame (eight balls of bright and three balls of nigger brown); two 14-inch lengths of steel tape as used on packing cases, or two corset steels of similar length; a No. 11 or No. 12 aero crochet hook.

METHOD

Cast on in red with 91 chain.

First Row: Double crochet into each chain (91 stitches).

Second Row: (a) One treble into each of five chain; three treble into next chain; one treble into each of next five chain; two chain (b).

Repeat from (a) to (b) finishing the row with a 5-3-5 pattern.

Turn each row with two chain to form the first treble.

Third Row: Change to green and continue pattern as in second row, making sure that the three treble in the one stitch is made in the centre of the three treble in the previous row.

Fourth Row: Change to yellow and continue pattern as in third row.

Fifth Row: Change to blue and continue pattern.

Sixth Row: Change to nigger brown and continue pattern.

Repeat from (a) until 25 patterns have been completed, ending with nigger brown.

Twenty-seventh Row: Work the row in treble using nigger brown.

Twenty-eighth Row: Work 33 treble using nigger brown, make 30 chain stitches for the handle, miss 25 treble of the previous row, then treble to the end of the row (33 treble).

Twenty-ninth Row: Turn and work 33 treble, then one treble into each chain stitch (30 treble) then 33 treble to end of row.

Thirtieth Row: Work 96 treble to end of row.

Thirty-first Row: Work same as thirtieth row.

Thirty-second Row: Work same as thirtieth row.

Thirty-third Row: Work 33 treble, cast off 30 treble, then continue 33 treble to end of row.

Finishing Off Below Handle: With a new nigger brown thread, make 25 treble into each of the cast off treble stitches on the bag. Repeat the row until four rows have been completed.

Thirty-fourth and Thirty-fifth Rows: Go back to the end of the bag and work two more rows (33 treble, 25 treble across the filled-in portion below the handle, 33 treble to end of row). Leave a thread for sewing up the bag.

Work a second side for the bag in exactly the same way.

Ends and Base.

Using nigger brown string, commence at the end of the 27th row on one side and work 54 treble down the side, 91 treble across the base and 54 treble up the other side.

Repeat this row four times and join the remaining piece to bag with chain stitch.

To Sew Up.

Take one handle and top-sew edges together. Fold the nigger brown section at top of bag in two and sew together to form a casing for the 14-inch length of steel tape. Insert the steel and turn the ends over with pliers, then sew up the ends of the casing so that the tape cannot slip out. Repeat on the other side of the bag.

If so desired, a zipp may be inserted at the top of the bag, but this is not essential.

FARMERS

This is YOUR Journal, and it has been written, edited and presented in a sincere endeavour to give you helpful information in an interesting manner.

We would like to have your views on the Journal—to know whether you like it or whether you don't. Drop a line to the editor and tell him the features you like and don't like in this issue—or the features you hope to see in future issues.

Weed Research...

by G. A. PEARCE B. Sc. (Agric)
BOTANIST, WEEDS & SEEDS BRANCH.

4.—Growth Stage in Cereal Crop Spraying

EACH year some 450,000 acres of cereal crops in Western Australia are sprayed for the control of weeds. Of this area more than two-thirds is treated from the air. During the present season 32 aircraft will be engaged in the weed spraying programme. This means that the aerial spraying capacity this year will be approximately double last season's operations.

The two most important weeds involved in this work are wild radish and wild turnip. Apart from making harvesting much easier, the removal of these weeds gives a considerable boost to grain yields. Increased yields of three or more bushels per acre can be expected. However, care is required because spraying during certain growth stages of the cereals can reduce yields by similar amounts.

TIME OF SPRAYING

It is generally known that the best time to spray a cereal crop for weed control is when it is from 6 to 10 in. tall. However, growing and seasonal conditions can vary so much that the need for weed control may not be apparent until the crop is well advanced.

Once the cereal has passed the tillering stage, careful timing of the application of

Fig. 1.—An unsprayed strip showing wild radish in a crop. The removal of such weeds give increased yields of grain as well as greatly facilitating the harvesting operation

the weedkilling chemical is required if the grain yield is not to be reduced.

RESULTS OF TRIALS

A number of trials have been undertaken in recent years to determine the effect on crop yields of spraying cereals at different stages of growth. The trials were carried out on wheat crops, completely free from weeds. Any reductions in yield were therefore due only to the treatment.

The following results were obtained by treating a wheat crop at the growth stages listed:—

Growth Stage.	Yield Per Acre. Bushels.
Seedling	15.4
Tillering	19.7
Boot and Flowering	13.1
Soft-Dough and Mature	17.6

These marked differences in yield illustrate the importance of avoiding spraying when the crop is at certain growth stages.

GROWTH STAGES

The above results show the importance of being able to recognise the different growth stages of cereals if it is intended to undertake spraying. For convenience these can be divided as follows:—

1. **Seedling Stage.**—This is the period from the time the seed germinates until it begins to stool or tiller. Each tiller produces one seed head. This growth stage occupies a period of some three to four weeks depending on growing conditions.

Spraying during this early growth period will cause reductions in yield depending on the actual size of the cereal plants when treated.

2. **Tillering Stage.**—The beginning of this growth stage is when the plants begin to stool or produce tillers. During this period the crop makes considerable growth and may be 18 in. tall before the next growth stage is reached.

This is probably the longest of the six growth stages and is the safest period in which to undertake crop spraying.

3. **Boot Stage.**—This is the comparatively short stage when the developing head is enclosed in the sheath of the flag leaf. The spraying of cereals in this growth stage causes considerable reductions in yield.

4. **Flowering Stage.**—At this stage the head has emerged from the sheath of the

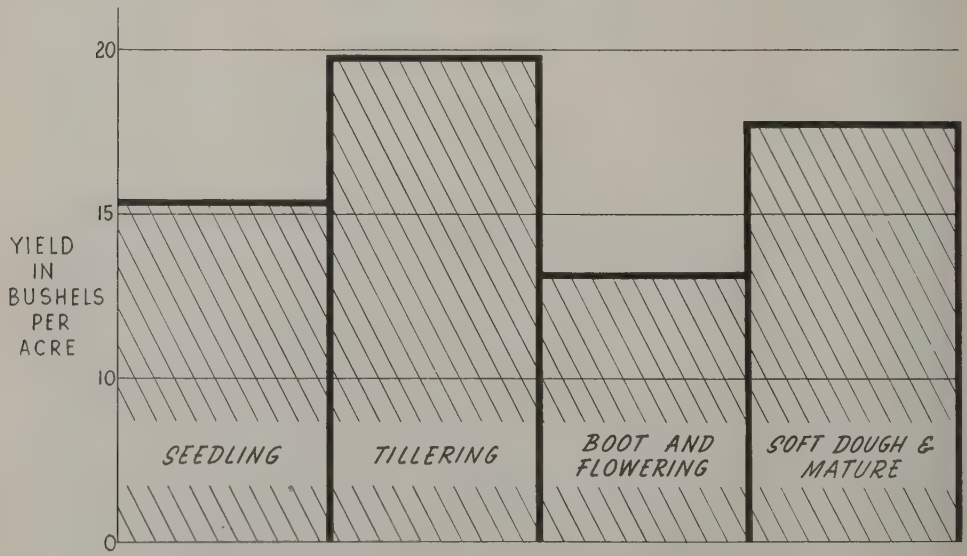


Fig. 2.—Graph showing effect on yields obtained by spraying a cereal crop at different stages of growth

flag leaf. The boot and flowering stages together only occupy a period of three to four weeks and crops in these growth stages should not be sprayed for weed control.

5. **Soft-Dough Stage.**—This growth stage is the period from when the grain actually begins to form until the crop matures.

From this time onwards cereal crops can be sprayed with comparative safety. However, treatment during this growth stage can only be regarded as an emergency measure. The reduction in yield due to the presence of the weeds will not be affected and the only advantage will be to cause the weeds to recede below the level of the crop.

6. **Mature Stage.**—This is when the grain has ripened.

OTHER CEREALS

Although the trials mentioned were only undertaken on wheat, both oats and barley would be expected to behave in a similar manner. It is generally recognised that wheat is more resistant to hormone-like weedkillers than barley or oats. For this reason similar reductions in yields must be expected if either a barley or oat crop is sprayed during the susceptible stages of growth already mentioned.

METHODS OF APPLICATION

1. **Aerial Application.**—In 1958 it is estimated that a little more than 300,000 acres of cereal crops were sprayed for weed control with aircraft. With the late opening to the present season, farmers were anxious to plant their crops as quickly as possible. Under these circumstances the weed problem is likely to be greater than usual so that a further expansion in aerial spraying is quite likely this year.

Fig. 3.—Spraying a cereal crop from the air. More than two-thirds of all crop spraying is undertaken by aircraft

Aerial operators in this State have developed very efficient techniques and results are remarkably consistent. Their technical efficiency is recognised as being the highest throughout Australia.

Aerial spraying has a number of advantages over ground spraying and the proportion of farmers making use of aircraft is steadily increasing.

2. **Ground Application.**—When cereal crop spraying was first commenced on a large scale in 1950, many farmers purchased their own spray units. With a 30-ft. boom fairly large areas can be covered in a short time with these machines. Great accuracy with rates of application can be obtained and any poor results are usually due to the faulty technique of the operator. However, despite the proven efficiency of ground spray units, many farmers have come to accept the idea that aircraft are the most practical means for crop spraying.

SUMMARY

1. Spraying cereal crops for the control of weeds gives increased yields and facilitates harvesting.

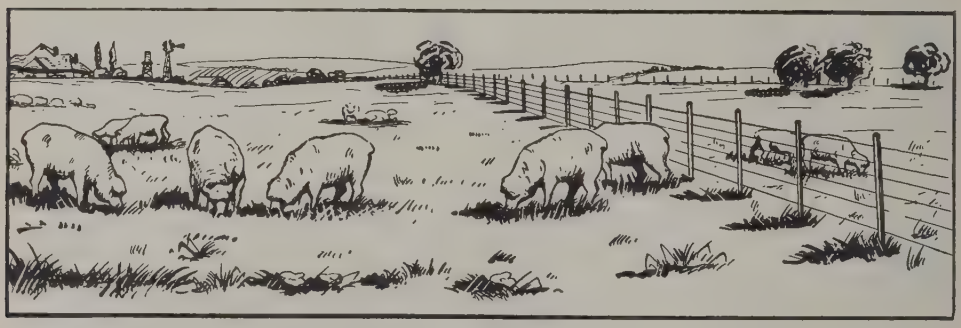
2. Crops treated with weedkilling chemicals when they are in certain growth stages are likely to give reduced grain yields.

3. The ideal time to spray crops is when they are in the tillering stage.

4. Where it is necessary to spray a cereal crop after it has passed the tillering stage, the treatment should be delayed until the crop has reached the soft-dough stage.

5. Spraying should not be undertaken in crops when they are in the seedling, boot or flowering stages.

6. Most cereal crop spraying is undertaken by aircraft although some is done by land units.



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Left—Untreated subterranean clover seed. Right—Seed pelleted with powdered limestone

Topical Notes on Seed Pelleting

By W. P. CASS SMITH, B.Sc. (Agric.), Superintendent, Biological Services Division

IT is evident from recent correspondence, that during the coming season, many farmers wish to test the method of inoculating and pelleting seeds developed by the Department of Agriculture for treating seeds of plants such as subterranean clover. They are anxious to know how the pelleted seed is prepared, the conditions under which it may prove advantageous, and details regarding availability and cost of materials.

Most commercial samples of pelleted seed are merely coated with powdered limestone, and the necessary peat culture of nodule-forming bacteria is dusted on to the coated seed just prior to planting.

When prepared by our technique however, the seed is first **wet inoculated** with the peat culture mixed in skimmed milk, to which has been added a selected sticking agent, known commercially as Cellofas A.

As soon as the seed is uniformly moistened with this mixture, very finely ground limestone is added immediately, and stirring continues until the seeds are thoroughly coated, and well separated. The pelleted seeds should then be allowed to set for about 24 hours before planting.

Small quantities of seed sufficient to plant a few acres, are easily prepared in this way in ordinary kitchen utensils, and for larger quantities, a **clean** cement mixer does a very satisfactory job.

It will be noted that in this seed-pelleting method, the nodule-forming bacteria are incorporated within the pellet of powdered limestone; and therefore they are afforded some protection against harmful contact with acid fertilisers such as superphosphate, and from rapid drying-out which are both fatal to the bacteria.

The value of this pelleting technique was amply demonstrated in an experiment conducted at Mr. Eric Smart's Mingenew property last year. Inoculated clover seed mixed and planted with superphosphate proved a failure—whereas inoculated seed mixed and planted with basic superphosphate gave excellent establishment. However, when **inoculated pelleted** seed was used the results with superphosphate were

also excellent and comparable with those obtained with basic super.

It is noteworthy too, that the inoculated pelleted seed for this experiment, was prepared in Perth, but because of unforeseen delays it was not planted at Mingenew until a week later. The lengthy survival of the bacteria within the pellets may prove beneficial when planting in dry soil is unavoidable, and if required, it will enable quantities for three or four days' seeding to be processed at a time.

The cost of seed pelleting by this method, compared with the extra cost incurred by using basic super. in preference to ordinary superphosphate, is well worth considering. At current prices, and excluding the cost of the bacterial culture, it will cost about 1s. 3d. an acre to pellet subterranean clover seed at a sowing rate of 6 lb. to the acre. On the other hand if a farmer who applies 1 cwt. of super. per acre, decides to use instead, basic super. containing an equivalent amount of phosphate, it will cost him an extra 4s. per acre.

Because of this difference in relative costs it is suggested that farmers who prefer basic super. for legume establishment should also test this seed pelleting method in conjunction with superphosphate fertiliser.

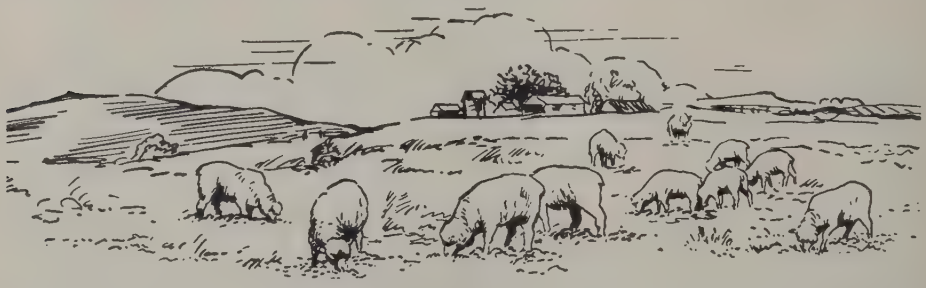
For pelleting 30 lb. of seed the requirements are 10-15 lb. of ground limestone—costing 3d. per lb. and 2 oz. of Cellofas A costing 1s. 10d.

These materials together with the appropriate bacterial culture are now readily available.

When planting inoculated pelleted seed with a small seeds attachment, the box should be kept full, as sowing rate decreases as the box empties. A planting depth of 1 to 1½ in. is also desirable, for if sown too shallowly, the pellets may be carried above ground on the seed leaves before they are disintegrated. The appropriate bacterial culture should be stored in a cool room or refrigerator until used, for at high temperatures it deteriorates rapidly.

Further details on seed pelleting may be obtained from your local Agricultural Adviser, or the Department of Agriculture.

(From a recent A.B.C. Country Hour broadcast.)



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We suggest that the Journal is worth keeping and that a year's issue will make an attractive and useful volume for your library—a volume that is full of sound factual information, attractively presented.

Arrangements have been made for the compilation of a comprehensive index to be incorporated in the December issue—a feature which will greatly enhance the value of the Journal as a work of reference.

Fig. 1.—An attractive head study of an emu

EMUS IN THE NORTHERN WHEATBELT

Notes on Observations — January 1958 to March, 1959

By C. D. GOODING, B.Sc. (Agric.), Research Officer, and
J. L. LONG, Research Technician

DURING the period from January, 1958, to March, 1959, advantage was taken of an opportunity to observe a population of emus (Dromaius novae-hollandiae) at close quarters and an effort was made to gain some knowledge of the breeding behaviour, feeding habits, the extent of range and the damage caused by the birds. The observations were collected while experimenting with methods to control the emu, during which, their reactions to colour, foreign food media and poisons were being studied.

Work was carried out on the property of Mr. J. R. Forrester & Sons of Yuna. The northern edge and 4½ miles of the eastern extremities of this property are bounded by an "emu-proof" fence, erected by the owner, which served both as a barrier to those birds moving in from outside and, for some periods, as an obstruction to those attempting to leave the property. The fence consists of 3 ft. 6 in. rabbit netting with three barbed wires on top, about 4 in. apart giving a total height of approximately 4 ft. 6 in. Posts (only few less than 6 in. in diameter), were spaced at 48 ft. intervals with three steel pickets between posts, the idea being to have a fence which was strong but had sufficient resilience to prevent it from being broken when hit by emus and kangaroos at speed. Only on one occasion was an emu seen to topple over the fence, and this was while being hotly pursued by a vehicle into a corner.

GENERAL BEHAVIOUR

Mostly, the birds were gregarious, moving about in bunches of between six and 30, although it has not been uncommon

to see solitary individuals, especially in the breeding season, and small groups of two or three birds. Among the large numbers there did not appear to be any well-marked flock grouping as is found with some domestic birds, especially poultry. The larger groups could merge with others without any friction being apparent, except that occasionally an individual emu —probably an old bird—was observed to peck at others. In no case however, was the action followed up and no attempt was made to cow the other birds.

During the winter months, bathing by the birds was fairly common. They were observed sitting upon their haunches in small claypans of muddy water splashing it about with their beaks and frequently fluffing out their feathers, while sometimes half-standing and shaking themselves vigorously.

Although possessed of a natural curiosity the emus were found to have extremely good eyesight and hearing and on many occasions were content to view strange objects from afar for a considerable period before examining them closely.

This was found especially so when highly-coloured materials were used to attract them to certain areas for the purpose of poisoning. Present indications are that they are blind to colour, relying more on the relative brightness of an object, gradually becoming less afraid as long as the object remained still.

At times, mainly on still mornings, all the emus would leave the observed area when a motor vehicle was started up at the homestead some 1½ miles away. They did not always disappear completely but would sometimes move into a small bunch and await the coming into sight of the vehicle, or, if none came would gradually disperse and commence feeding again.

BREEDING SEASON AND BEHAVIOUR

The first indication of the breeding season was gained when a female bird shot on May 14 contained 14 partly-developed eggs ranging in size from that of a pea to almost full size (20½ oz.).

The first chicks were seen in August and were then estimated as being from two to three weeks of age, being approximately 7 to 12 in. high. This would place the hatching in late July and the probable laying time—taking the average incubation time of 58 to 61 days—in the latter half of May. This clutch of five young was then used as the "yardstick" for all the others and placed the laying time of these birds as being from approximately the end of April until the beginning of June. The largest clutch seen was 13 and one bird had only a single chick.

From observations on half-grown chicks when work started in January 1958 and with the advent of more during the year it would appear that the chicks take at least two years to reach maturity. Those estimated at 13 to 14 months old were still at the "squeaking" stage and had not developed the "booming" or guttural noises characteristic to this species. Most of the year's clutches had lost the striped juvenile plumage by October and developed feathering similar to that of adults, but much darker by comparison.

POPULATION MOVEMENTS

The number of adult birds increased in October and November, indicating that some migration of birds from adjacent areas on to the property had occurred. These birds, which we shall call the "migratory population" were easily frightened from the property by human interference (in December), but the "hard core" of the resident population remained with their chicks to feed on the observation area.

The number of the chicks in the area did not fluctuate materially during late spring and summer. There was a normal build-up in chick numbers such as would be expected from August-November and a gradual decline from December onwards as individual clutches of chicks left the area with their parents. This was borne out by direct observation. There appeared to be very little mortality in the chicks from the time they were first observed in the very young striped stage (some two to three weeks of age) until they were several months old, as individual clutches were easily recognised by their number, size and feeding area.

FEEDING BEHAVIOUR AND FOODS

The most notable behaviour in the early stages, (January to August) was the extreme mobilty of the birds while feeding.

Fig. 2.—Emus feeding in the observation area

They moved continuously about old crop stubble and pasture seeking food (up until the time the crop came into ear). When wild radish and other natural pasture commenced coming into head they confined their activities to the portions of the property where these plants were plentiful. Generally, feeding commenced shortly after daybreak and birds did not leave the observation area until dusk, unless disturbed.

From September until almost the end of December, birds would cross pasture paddocks to feed in and on the grain crops, where their movements seemed very restricted in comparison with former mobility. As the crops gradually dried off it was noted that any tendency to congregate was on those patches which retained some green longer than the remainder.

It would appear then that the emus preferred "seeding heads" at this period of the year. This fact was also borne out by the failure of the birds to take experimental grain during this period.

When feeding in the same paddock as sheep they usually feed in among them without disturbance, but if frightened seemed to do their utmost to also panic the sheep. This type of behaviour is apparently common as it was recorded by other authors as early as 1913-14.

Wheat constituted the main diet of these birds for the greater portion of the year. Grain was available to them from the end of August to Mid-November as growing and ripening crop, and from that time until approximately mid-January as mature grain. Most of the spilled and wasted grain was soon eaten, and from the end of February to seeding time (April-May) it was in relatively short supply although some small quantity was still available amongst the stubble. During 1958 only June-July and early August were grainless and it was in this period that large quantities of green grass and caterpillars were consumed.

CROP AND OTHER DAMAGE

An accurate assessment of the damage caused by this population would be very difficult to make. Prior to the commencement of this work the owner of the property estimated that the emus cost him £1,000 annually.

The damage during the year could be divided into four sections:-

(a) To Pasture, Mainly during Winter Months.

During the winter months when food consisted mainly of natural pasture, damage was not visible and could not be separated from that caused by sheep. The number of caterpillars consumed by the birds during this period probably outweighed any destruction to the pasture.

Fig. 3.—Small group of emus resting

(b) Damage at Seeding Time.

For a short period after seeding and before germination there was quite an appreciable amount of grain either left uncovered or dropped during these operations. After germination the crop showed no visible ill-effects from emus grazing on the uncovered grain.

(c) To the Growing and Ripened Crops.

It was quite obvious as the crop ripened that this would be the time when the emus would be the greatest nuisance. Coinciding with the maturing of the grain crops the migration of birds previously mentioned, swelled the numbers of the existing resident population and it was only in these months that any real damage was noticed. No real estimate of the percentage destruction to the crop was attempted as the factors involved in such an estimate were far too numerous. Other animal and bird damage, such as is caused by kangaroos, rabbits, galahs and sheep would have to be excluded. It was hard to trace individual birds through the crop even when chased but probably more damage would be caused by a very large number of birds.

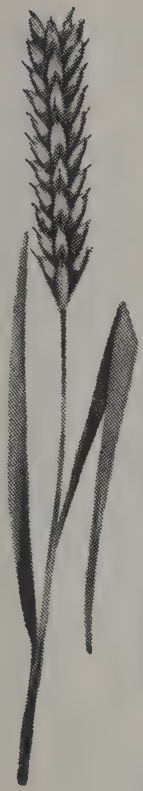
(d) To Fencing.

No accurate estimate of damage to fencing could be given although wire and netting breakage by the birds was definitely known.

ACKNOWLEDGMENTS

The assistance of Mr. F. J. Forrester, particularly in making his property available for these observations is gratefully acknowledged. Thanks are due to Mr. A. R. Tomlinson, Agriculture Protection Board, and Dr. D. L. Serventy, Wild Life Survey Section, C.S.I.R.O. for their help in reading the draft.

If Only Wheat had More than EARS!



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SOUTH TERRACE . . . . FREMANTLE

WARTED YATE *(Eucalyptus magacornuta* C. A. Gardn.)
A—Leaf; B—Anther; C—Flower buds; D—Fruit; E—Section of Fruit

TREES OF WESTERN AUSTRALI

By C. A. GARDNER, Government Botanist

No. 35—THE WARTED YATE

(*Eucalyptus megacornuta* C. A. Gardn.)

THE Warted Yate was originally discovered by the writer in 1927 in the Ravensthorpe Range, and to date it is a tree of restricted habitat in that the species has not been found occurring naturally in any other locality.

The tree, which attains a height of 25 ft., resembles the gimlet tree in some respects, having smooth, rather thin, ashy-brown bark, a branching habit not unlike the gimlet, and hard, dark yellowish-brown timber. In other respects however, there is no resemblance.

The Warted Yate is remarkable for its large green-filamented flowers, and its densely-warted bud-cap or operculum. This, as the accompanying illustration shows, is long and horn-like except that it is obtuse at the tip. The base of the operculum shows a pronounced dilation with a dense row of closely-placed tubercles—those on the remainder of the cap being irregularly scattered.

Only two or three flowers occur at the end of the very thick flower-stalk (peduncle) which is dilated upwards, and the flowers are pendulous. These buds are more than three inches in length, so that the flowers are relatively large. The green stamens are not incurved before the bud expands, but remain erect and wavy within the operculum. The fruit is hard and woody, somewhat bell-shaped and nearly one and a half inches in length. Broad processes of the disc overlie the valves.

The Warted Yate is regarded by apiarists as one of the best nectar-producing species of Eucalyptus in Western Australia, and its planting on an extensive scale might serve a twofold purpose—as it is a very desirable shade tree and one which is valuable for honey production. The leaves are very rich in oil, but this has not been chemically examined.

The tree grows in small pure stands in the gravelly declivities of the Ravensthorpe Range, and it flowers in October and November. In cultivation it has proved hardy in the banksia and tuart sands of the metropolitan area.

No. 36—THE CROWNED MALLEE

(*Eucalyptus coronata* C. A. Gardn.)

ON the hills of the south coast extending from and including Middle Mount Barren and East Mount Barren, the Crowned Mallee is found in scattered spots. Originally discovered on Middle Mount Barren in 1926, it has subsequently been found in other places, principally around East Mount Barren, growing among quartzite rocks and attaining a height of about five feet, although usually less. In cultivation it grows somewhat taller, and has been widely cultivated in Victoria for windbreak purposes.

The principal features of the species are the remarkable ribbing of the buds and fruits, the curiously-shaped bud cap broadly and horizontally expanded at the base with the ribs expanded at the point where the cap joins the calyx, and the large globular tubercles which cover the valves of the fruit. The fruit-valves, and correspondingly the tubercles, vary from four to six, and it is this "crown" of

CROWNED MALLEE *(Eucalyptus coronata* C. A. Gardn.)

A—Leaf; B—Flower-buds; C—Single Flower-bud; D—Section of Flower-bud; E—Anthers; F—Branchlet showing Fruits; G—View of Fruit from above; H—Seeds; I—Section of Fruit

BULLICH (*Eucalyptus megacarpa* F. Muell.)

A—Branchlets with Leaves and Flower-buds; B—Anthers; C—Fruits; D—Section of Fruit; E—Seeds; F—Cotyledons

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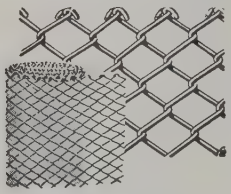

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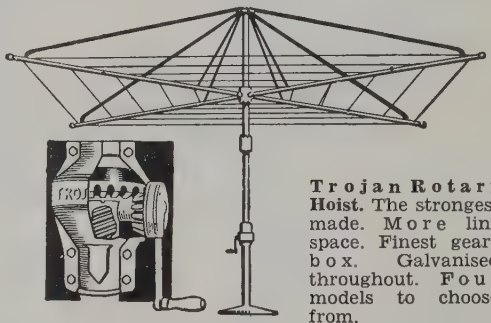

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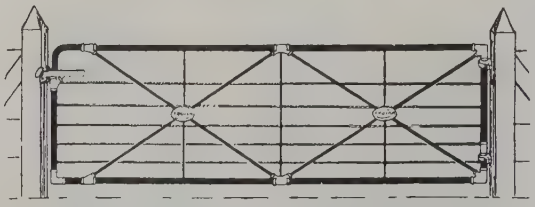

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appendages which gives the mallee its common name. The filaments of the flowers are a pale yellow in colour, and expand to a diameter of nearly one and a half inches.

The Crowned Mallee would be a desirable species to plant in gardens. The flowering season is in July and August.

Another attractive feature of the quaintly-sculptured fruit is the broad wavy flower-stalk which is rigid, and takes on a variety of shapes.

The plant has proved hardy in many types of soil, and would be suitable for planting anywhere where the annual (winter) rainfall is in excess of 12 inches.

No. 37—THE BULLICH

(*Eucalyptus megacarpa* F. Muell.)

THE name "megacarpa," meaning large-fruited, is not particularly appropriate, for compared with other Western Australian species of Eucalyptus, the fruits are not large. The species takes on two distinct forms. A tree form is found mostly in wet soils in the karri and southern jarrah forests extending from Jarrahdale on the Serpentine River to the vicinity of Albany, and also on the limestone soil of the valleys at Yallingup. A mallee form is found on the mountains of the Stirling Range, in shale and quartzite; this form is also found as far east as the Barren Hills. Both forms are attractive.

The tree form is not widely cultivated, but those who have seen specimens growing in the grounds of the University at Nedlands, not far from the river at Crawley, will have observed what must be regarded as one of the finest of our *Eucalyptus* species of the gum-tree type—trunks of an alabaster whiteness with large patches of unshed violet-grey outer bark, and a very dense crown of dark green leaves. Unfortunately I do not regard this tree as suitable for planting, except in places where its roots can reach to the water-table, but where it can be grown it must be regarded as one of our best and most attractive shade-trees. The timber is very straight-grained, and pale in colour.

The mallee form found on the Stirling Range and adjacent quartzite hills, varies from 4 to 10 ft. in height and is a shrub with dark green leaves.

The main characteristics of the species is to be found in the fruits which are globular-hemispherical with a prominent rim, and the disc of the fruit is continuous with the valves. The flowers are white, and the species flowers in October and November. The leaves yield 0.5 per cent. of oil.

No. 38—THE BELL-FRUITED MALLEE

(*Eucalyptus preissiana* Schua.)

THE Bell-Fruited Mallee is one of the most attractive of our small shrubby species of Eucalyptus. It is found in the south coastal districts from the west end of the Stirling Range as far eastwards as Stoke's Inlet. Rarely exceeding three or four feet in height, and of untidy, straggling habit, with stiff, blunt, grey-green leaves, its shortcomings in these respects are more than outweighed by its magnificent blossoms of rich yellow, and its attractive bell-shaped fruits. It grows in poor soils, such as stony sandstone country, usually on the open heath.

The name commemorates Ludwig Preiss, a botanist who visited the Swan Colony in 1838 and resided here for four years. He often travelled with James Drummond, collecting specimens of plants and birds for the Hamburg Museum, and he penetrated as far inland as Wongan Hills, and took an overland journey to King George's

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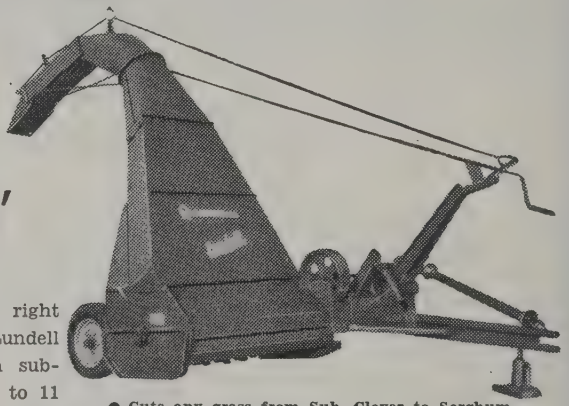

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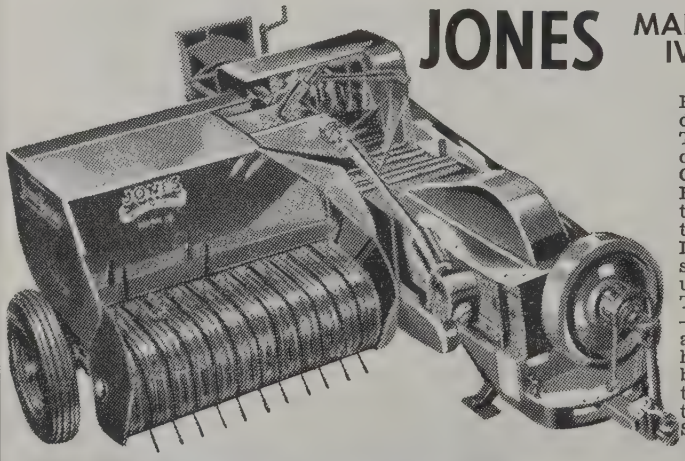

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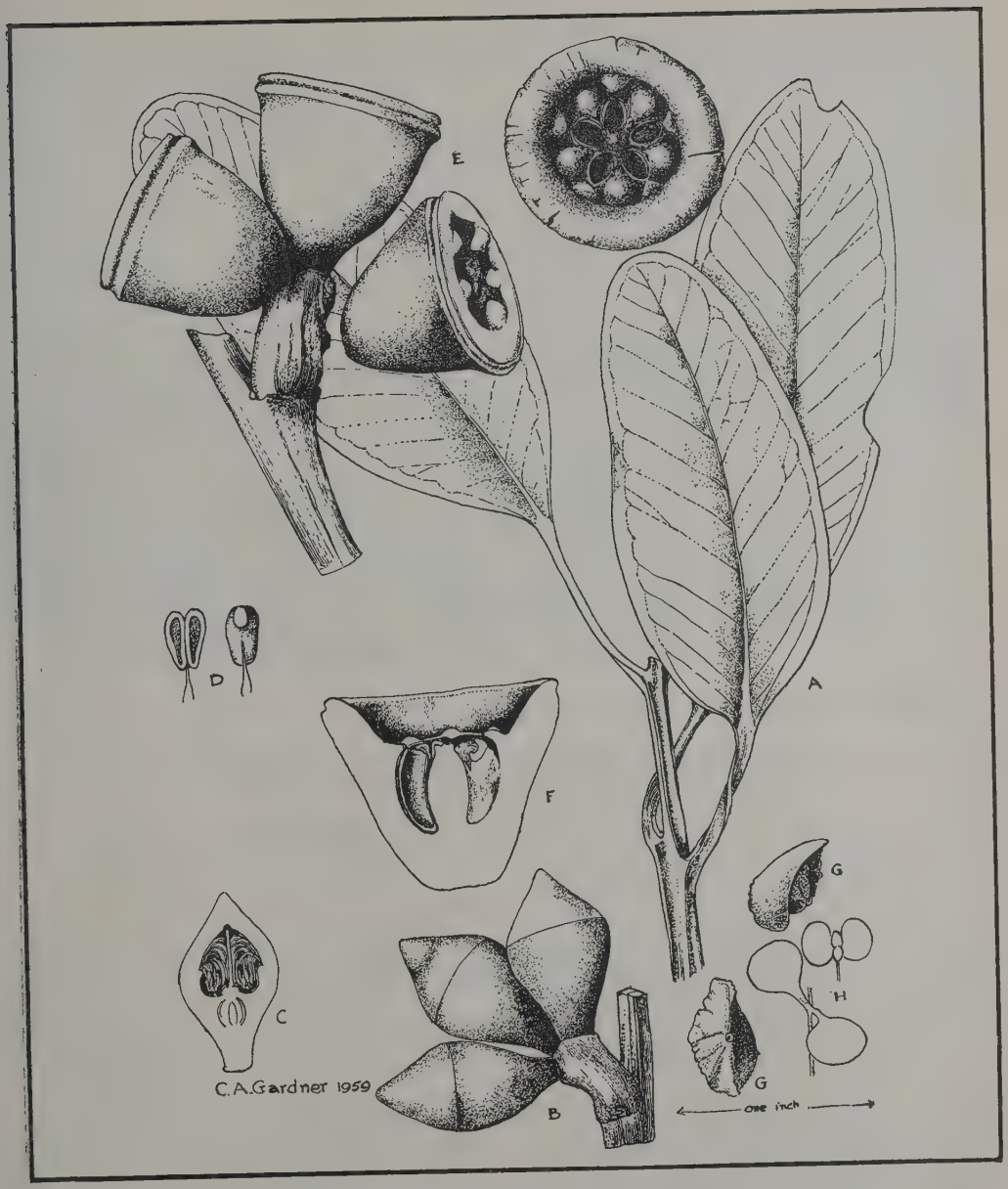

BELL-FRUITED MALLEE (*Eucalyptus Preissiana* Schau.)

A—Branchlet with leaves; B—Flower-buds; C—Section through Flower-bud; D—Anthers; E—Fruits; F—Section of Fruit; G—Seeds; H—Expanded cotyledons

Sound far to the east of the present road. He collected this specimen on the hills of Cape Riche, and describes the plant as being 8 ft. tall.

The Bell-Fruited Mallee is well known in cultivation, but none of the specimens seen in the metropolitan area compare with the forms seen in the native habitat, the flowers losing much in size and intensity of colour.

The species shows considerable variation in the shape of both the bud and the fruit. The accompanying plate is taken from material collected near the Fitzgerald River—about the centre of its area of distribution—and may therefore be taken as fairly typical. The budcap (operculum) varies from merely convex to distinctly conical, and is usually red in colour; the fruits normally have the tubercles over the valves (as shown in the Plate) in the typical form, but sometimes these are small and not at all conspicuous. A form with small fruits and the disc tubercles almost non-existent is found on the Kalgan Plains, and was formerly named *Eucalyptus kalganensis*.

The species is one deserving of a place in gardens. It thrives in almost any type of soil, and would prove hardy in the wheat-growing areas of the South-West, especially when grown with other small shrubs such as *E. terraptera*, the four-sided mallee, or *E. macrocarpa*. The flowering season extends from August to November.

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Fig. 1.—Rock phosphate mining on Christmas Island. After removal of the indigenous trees and about 3 feet of soil overburden, the layer of rock phosphate is exposed. It is about 30 feet deep and lies among limestone pinnacles, some of which, now freed of phosphatic rock, are seen on the left of the picture.

Photo by courtesy of British Phosphate Commission.

CHRISTMAS ISLAND ROCK PHOSPHATE IN POULTRY FEEDING TRIALS

By P. SMETANA, Agricultural Adviser, and D. K. GILES, Agricultural Adviser

IN Western Australia, increasing quantities of ground rock phosphate from Christmas Island are being incorporated in stock foods to increase the calcium and phosphorus content. In a previous article (Snook 1958) experiments are reported which indicate that this particular rock phosphate can be incorporated in the rations of laying hens without any apparent effect on the health or productivity of the birds.

A further series of experiments have been carried out at the Poultry Research Station, Herdsman Lake, to determine the effect of feeding ground rock phosphate from hatching to the end of productive life. Tests were also made to determine if rock phosphate supplements had any effect on hatchability.

The experimental findings are discussed under the heading of Rearing, Laying and Hatching.

REARING

On September 5, 1955, 108 day-old first-cross pullets were obtained for an experiment. The birds were brooded for the first four weeks in metal cages with litter floors and then reared intensively in wooden colony cages with slatted floors until the pullets were 18 weeks old. During this period the birds were subjected to three treatments with 36 birds on each treatment, and three replications of 12 birds

within each treatment. The three treatments will be designated hereafter as C37, C38 and C39, these numbers referring to the ration numbers.

Essentially the three groups consisted of a ration without mineral supplements (C37), a ration with approximately 2 per cent. rock phosphate (C38) to supply the mineral requirements, and a normal ration (C39) with bonemeal and oyster flour supplying calcium and phosphorus.

Ration C37 contained 1.3 per cent. calcium and 0.63 per cent. phosphorus. The entire available calcium and phosphorus content of this ration was supplied by the protein rich foods whalemeal and meatmeal. Despite the absence of mineral supplements in this ration, the level of 0.63 per cent. phosphorus is well above 0.5 per cent. which is regarded as being the minimum requirement for chickens. A level of 1.3 per cent. calcium is also above the usual recommendations of 1.0 per cent. Therefore, although no mineral supplements were included, the ration should have been adequately supplied with both calcium and phosphorus.

This is explained by the fact that the rearing diets contained 18 per cent. crude protein instead of the lower levels of protein usually fed to replacement stock. The extra whalemeal and meatmeal used to maintain an 18 per cent. protein ration in addition to supplying extra protein also provided additional calcium and phosphorus.

Ration C38 contained rock phosphate at the level of 1.97 per cent. which gave the ration a calcium content of 1.96 per cent. and a phosphorus content of 0.98 per cent. It was thought that this ration would be suitable as a rearing ration unless the fluorine content was high enough to cause fluorosis.

The third ration, C39, was similar to C38 but there boneflour and oyster flour were used to supply the mineral requirements. This ration contained 2 per cent. calcium and 0.77 per cent. phosphorus.

Both ration C37 and C38 have calcium and phosphorus contents in excess of the usual recommendations. It is generally recommended to feed about 1 per cent. of calcium and 0.6 to 0.8 per cent. of inorganic phosphorus until maturity. Unless amounts greatly in excess of the above figures are fed it is unlikely that any adverse effect will result as there seems to be a certain amount of tolerance by the birds in this respect. On the other hand it would not be advisable to feed less than 0.5 per cent. phosphorus in a commercial feed.

During the rearing period the birds were weighed at monthly intervals and a check was also kept of feed consumption. It was found that feed consumption for the three groups was similar and from Table I (below) it will be noticed that the growth rates of the birds on each treatment were practically identical. It would seem that each of the three rations used was suitable for the rearing period, as not only are the body weights the same, but they are also most satisfactory by normal standards.

Table I

Ration	Body Weight Average Weight per Bird		
Weeks	8	16	20
	lb.	lb.	lb.
C37	1·1	2·75	3·20
C38	1·10	2·75	3·30
C39	1·08	2·71	3·20

During the first four weeks while the chickens were in 12 bird cage brooders, the percentage mortality for the three treatments was as follows:—

Table II

Mortality to	C37	C38	C39
	%	%	%
4 weeks	11·1	27·8	5·5
20 weeks	11·1	33·3	11·1

It will be noticed from this table that chickens on the rock phosphate treatment had a high mortality rate during the first four weeks. For this reason it was important to determine whether rock phosphate was in any way connected with these deaths or whether other causes were responsible. A study of available literature failed to reveal reports of sudden deaths which could be ascribed to excessive fluorine in the diet. The survivors in this trial grew as well as the birds in the other groups. It seems reasonable to attribute the death to faulty brooding. However,

to eliminate all doubt in this regard the trial was repeated in 1958.

In this second trial the chickens were subjected to three treatments with six replications of five birds on each treatment. The first treatment consisted of a normal diet containing 16 per cent. protein and bonemeal and supplying 1.1 per cent. calcium and 0.6 per cent. phosphorus. In the second treatment 2 per cent. rock phosphate replaced the bonemeal giving 1.9 per cent. calcium and 0.9 per cent. phosphorus. The third treatment was the same as the second except that the rock phosphate level was doubled in order to double the fluorine content.

At five weeks of age one death had occurred in each of the control and 2 per cent. rock phosphate groups while four chicks had died in the group receiving 4 per cent. rock phosphate. Two of the four chickens that died on 4 per cent. rock phosphate were submitted for laboratory post-mortem but the cause of death could not be determined.

At the age of eight weeks a bone analysis was made on nine birds (three from each treatment). The fluorine content of the ash in parts per million is given below:—

Table III

Ration	Fluorine in Ash
	ppm.
Control	5,300
2% Rock Phosphate	9,200
4% Rock Phosphate	10,300

The significant feature of this second growing trial is that only one chicken died of the 30 which were raised on the ration containing 2 per cent. rock phosphate. This gives a percentage figure for mortality of 3.3 which is in contrast with the 27.8 per cent. mortality for the first four weeks obtained from the trial caried out in 1955 using an identical ration. In the light of this new data it would appear that the high mortality of 1955 was due to causes other than the use of rock phosphate.

The chickens used in this second experiment were reared until the age of eight weeks. Body weight, feed consumption and conversion ratios are given in Table IV. These figures refer to eight week old pullets. It is interesting to note that the birds on the 2 per cent. rock phosphate diet had the best conversion ratio.

Table IV

Ration	Rearing Results		
	Body Weight at 8 weeks. Average Weight per bird in lb.	Feed consumption per bird in lb.	Conversion Ratio
Control	0·873	3·65	4·18
2% Rock Phosphate	0·894	3·68	4·12
4% Rock Phosphate	0·855	3·71	4·34

The "within treatment" variation was far greater than the "between treatment" variation, therefore the differences in body weight are not significant and neither treatment had an effect on body weight.

A third rearing trial was carried out in 1959. This trial consisted of two treatments with 120 pullets in each treatment and six replications of 20 within the treatments. The two rations used were a standard chick diet which served as the control ration and another similar ration except that ground rock phosphate from Christmas Island was included at a 2 per cent. level.

The 12 groups of 20 chickens were selected at random at day old and brooded under similar conditions in wire cages with deep litter floors and hot water pipes supplying heat. At the age of 5½ weeks the birds were transferred within their groups to six rearing sheds where they remained until the end of the experiment when the birds were ten weeks old.

Accurate records were kept during the experiment and in Table V, mortality, body weight gains and conversion ratios for the two groups are compared.

Table V

	Percentage Mortality		Average Body Weight per Bird in ozs.			Conversion Ratio
	To 4 Weeks	To 10 Weeks	4 Weeks	8 Weeks	10 Weeks	10 Weeks
2% Rock Phosphate	8·3	8·3	6·112	17·000	25·110	3·68
Control	15·8	15·8	6·064	16·871	24·460	3·80

Fig. 2.—Metal brooding cages heated by electric light globes were used to brood the chicks in the first rearing trial.

The majority of the deaths on diagnosis were found to be due firstly to a vitamin E deficiency, which was overcome by the addition of fresh wheat germ, and later to uraemia which was effectively treated by the use of the antibiotic terramycin. From the above figures it is evident that rock phosphate, because of its fluorine content was not responsible for the deaths as not only was the mortality of the rock phosphate group considerably lower than that of the control group but also the number of deaths was not excessive by normal standards. Of the ten deaths which occurred in the rock phosphate group, diagnosis showed that three were due to vitamin E deficiency, four died from uraemia and the remaining three were unsuitable for post-mortem examination.

As in the other two rearing experiments, growth of the rock phosphate fed birds compared very favourably with that of the control groups and there was no evidence of any growth depression which could be ascribed to the fluorine content of ground rock phosphate. Indeed in this trial the birds on rock phosphate once again were slightly heavier in weight on the average than the control flock. The range in individual body weights of birds on the two treatments was measured at the age of ten weeks and this too was found to be almost identical for the two groups.

The ground rock phosphate used in this trial was procured from a fairly recent consignment. A sample of this was submitted to the Government Chemical Laboratories for analysis and was found to have the following composition:—

	Rock Phosphate.
	%
Calcium (Ca)	35.6
Phosphorus (P)	16.6
Fluorine (F)	1.35

SUMMARY OF REARING RESULTS

It has been general practice in this State to omit rock phosphate from the diet of all young stock, because of the uncertainty of the effect of the fluorine content in rock phosphate. Three trials have been carried out to gain information on this matter and although the first showed a high mortality rate in chickens which were fed a 2 per cent. level of rock phosphate, the second trial gave a very low mortality figure, and in the third trial the mortality was considerably lower than that for the control group. It would be expected that if rock phosphate was injurious to chickens a similar result would be obtained for each trial but as this was not the case it strongly suggests that the deaths in the first trial were due to other factors.

When chickens are fed excessive amounts of fluorine their growth rate is markedly depressed especially during the first eight weeks. The results of this experiment indicate that the group on rock phosphate in the first trial showed no decrease in body weight over the control groups. In the second and third trials the birds on 2 per cent. rock phosphate were slightly heavier than the chickens in the respective control groups. This satisfactory growth rate shown by the chickens fed on rock phosphate is a most significant feature as far as the safety of rock phosphate as an ingredient in poultry diets is concerned.

Where phosphorus rich materials are in short supply it now seems fairly certain that rock phosphate may be used for young stock as well as adult birds. A most important consideration here is to ensure that the level of rock phosphate never exceeds 2 per cent. in chicken diets.

LAYING

On February 9, 1956, when the birds in the first rearing experiment were 22½ weeks old, they were transferred from the wooden colony cages to nine small deep litter pens. The rations were changed at this stage to a 16 per cent. protein laying mash and redesignated as Rations 249, 250 and 251 instead of C37, C38 and C39 respectively. These new rations had the following compositions:—

Table VI

	Laying Rations		
	249	250	251
	lb.	lb.	lb.
Bran	30	30	30
Pollard	10	10	10
Oats	10	10	10
Wheatmeal	50	50	50
Whalemeal	7	7	7
Meatmeal	7	7	7½
Rock Phosphate	*Nil*	2	*Nil*
Boneflour	*Nil*	*Nil*	3
Oyster Flour	4	2½	3
	118	118½	120½
	%	%	%
Protein	16·10	16·10	16·20
Calcium (Ca)	2·26	2·34	2·63
Phosphorus (P)	0·48	0·80	0·80

In addition to the above ingredients, a vitamin A and D_3 supplement, salt, manganese sulphate and greenfeed were included in each ration at optimum levels.

Soon after the birds were placed in the deep litter pens there was an outbreak of uraemia (bluecomb). This was treated with molasses and although there was a response it was short lived, a deterioration occurring after the first week. At this stage the antibiotic, terramycin, was used in place of molasses. Response was rapid, the birds recovered completely but egg production was low for several weeks.

The laying trial extended from February 9, 1956, to December 1, 1956, the records kept being egg production, feed consumption and mortality. On June 21, 1956, the rations given above (249, 250 and 251) were replaced by breeders' rations in order to carry out hatchability trials. One week later (June 28, 1956), cockerels were put in with the hens and a fertility and hatchability trial commenced.

The following figures refer to the 42 week laying period:—

Table VII—Percentage Lay and Hen Housed Figures

Ration	249	250	251
Average Percentage Lay, 9th February to 1st December	52·36	49·18	50·74
Hen Housed Figure	162	146	134

It is evident from the percentage lay figure that there was no significant difference between the three treatments as far as egg production was concerned. The comparatively lower hen housed figure of 134 for ration 251 is explained by the fact that the group of birds on this ration had a higher mortality than the other two groups. These deaths could not, however, be related to the ration. There was a considerable variation between replications which further indicates that egg production was not influenced by any of the rations. This result is consistent with that obtained in the experiment conducted at the Animal Health and Nutrition Laboratories and reported in a previous issue of the Journal of Agriculture.

The feed-consumed-per dozen eggs figure from February 9 to December 1, 1956, was as follows:—

Table VIII

Ration	Lb. Feed per Dozen
249	6·56
250	7·14
251	6·83

HATCHING

One of the reported effects of a high fluorine intake in poultry is to depress hatchability. In order to determine whether this was the case with the treatment on rock phosphate, all the birds which had been raised from day-old were mated and the eggs used for incubation.

The birds undergoing egg production trials were placed on a breeders' ration with the following constituents:—

Fig. 3.—Three of the 12 hot water brooding units used in the second and third rearing trials.

An interesting feature arising from these results is that the birds on ration 249 which contained only 0.48 per cent. inorganic phosphorus, gave a slightly better performance than the other treatments. This indicates that laying birds seem to have a fairly wide tolerance to the phosphorus level in their diet. However, these birds would be on a ration very near the lower limit for this mineral and it should be stressed that a margin of safety is advisable and the level should not be allowed to fall below 0.6 per cent.

A wet litter problem in the industry caused by liquid droppings has at times been suspected to be due to the feeding of rock phosphate to laying birds. During the course of the experiment at the Poultry Research Station a constant check was kept on the consistency of the droppings of those birds on rock phosphate but no abnormal droppings were observed.

Table IX

Ingredients	Ration		
	249	250	251
	lb.	lb.	lb.
Bran	17½	17½	17½
Pollard	7½	7½	7½
Wheat (Coarsely Gristed)	10	10	10
Oats (Finely Gristed)	5	5	5
Whalemeal	4½	4½	4½
Meatmeal	3½	4	3½
Skim Milk Powder	2	2	2
Dried Brewer's Yeast	1½	1½	1½
Oyster Flour	3	1	1
	oz.	oz.	oz.
Common Salt	4	4	4
	lb.	lb.	lb.
Rock Phosphate	*Nil*	2½	*Nil*
Boneflour	*Nil*	*Nil*	3
	gms.	gms.	gms.
Manganese Sulphate	1½	1½	1½
Synthetic Riboflavin	As recommended by Manufacturer		
Vitamin A and D_3 Supplement	do.	do.	do.

Also 1½ oz. of wheat per bird was fed daily.

On June 28, a week after the birds had been on a breeders' ration, cockerels were placed into each deep litter pen. Nine Australorp cockerels from two families were used in such a way that each cockerel was left in a particular pen for only five days, thus overcoming fertility effects which could arise due to the sire.

Three weeks after mating, a start was made to save the fertile eggs. All eggs laid by the birds on the three treatments were placed in the incubator, regardless of size and quality. This procedure was continued until October 4, 1956 and the fertility and hatchability measured. A summary of the results is given in the following table:—

Table X

	Ration 249–Control	Ration 250–2% Rock Phosphate	Ration 251–Bone-flour
Number of Eggs Set	742	580	362
Clears 6th day	53	61	11
Dead in Shell 6th day	26	17	9
Dead in Shell 18th day	9	8	7
Dead in Shell day of Hatch	107	57	45
Hatched	547	437	290
Fertility (%)	92·9	89·5	97
Hatchability on Eggs Set (%)	73·7	75·3	80·1

It can be seen from Table X that fertility was lowest in the group of birds on the rock phosphate ration. However, too much significance cannot be placed on this fact as low fertility was not evenly distributed over the three pens on the rock phosphate treatment. Of the three pens, one had 62 per cent. of the infertile eggs whereas another pen had only 8 per cent. of the total infertile eggs for the group. Also the occurrence of "clears" did not follow a pattern over the different hatching dates, which suggest that the presence of rock phosphate did not necessarily account for this slightly lower fertility figure.

When hatchability figures for the three treatments are compared, no noticeable difference is evident. This would indicate that rock phosphate at the level used in this experiment was not injurious to hatchability. After considering the egg production trials where the group on rock phosphate compared favourably with the others, it would have been reasonable to expect a negative response from the eggs hatched from the group on rock phosphate as egg production is usually affected before hatchability if the fluorine content of the ration is at a dangerous level.

CONCLUSIONS

The possibility was examined of utilising Christmas Island rock phosphate as a source of phosphorus and calcium in poultry rations. From the experimental data it may be concluded that rock phosphate can be successfully used for laying birds without noticeably affecting either egg production or hatchability. Confirming evidence was obtained in regard to the feeding of rock phosphate to young stock, the most noticeable feature being the similarity of the growth rates of the birds on the different rations.

When using rock phosphate in poultry diets the following points should be kept in mind.

Firstly the level of rock phosphate in a chicken ration should not exceed 2 per cent. Secondly it is possible that some variation in the fluorine content of various samples of rock phosphate may differ appreciably especially where shipments from different localities are concerned. Fortunately all of the rock phosphate available in this State at present is derived from the same area (Christmas Island) and would be fairly uniform in composition. If at any future date rock phosphate is imported from other sources it would be necessary to analyse samples and carry out further feeding trials.

From the results of these experiments and the findings of Dr. L. C. Snook (The Journal of Agriculture of Western Australia Volume 7 No. 5) it can be concluded that when 2 per cent. Christmas Island rock phosphate is included in poultry ration, the fluorine content is not high enough to have any deleterious effects on the birds, and this ingredient may be safely included in all rations wherever it is so desired.

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LICE ON CATTLE

(CONTRIBUTED BY THE VETERINARY BRANCH)

BEEF and dairy cattle of all ages are liable to lice infestation and these parasites can be responsible for serious financial losses as their presence leads to retarded growth rates and reduced milk yields. This is easily understood when it is realised that lice-infested animals spend much of the time, normally devoted to feeding and rumination, in rubbing and scratching to allay the irritation caused by the parasites.

Most types of birds and animals have their own species of lice and these are specific to their hosts—pig lice, for instance, would soon die if transferred from pigs to cattle or horses.

Lice are usually grouped in two main classes—sucking lice and biting lice. The sucking lice have conical heads and strong legs terminating in powerful claws. The eyes are absent in the *Haematopinus* species to which the common sucking lice of domestic animal belongs.

Sucking lice are, in general, regarded as being responsible for far greater losses than biting lice. They cause considerably more irritation owing to their habit of feeding in clusters or colonies and of piercing skin and sucking the blood and tissue fluids.

The biting lice are less irritating, since they feed on the scurf and hair on the skin surface. Biting lice are characterised by their broad heads and all bird-lice and some mammalian lice belong to this group.

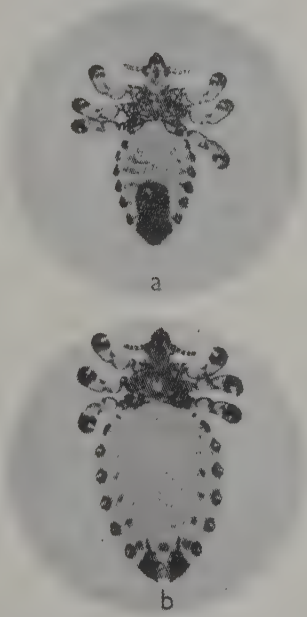

Fig. 1.—The Short-Nosed Sucking Louse. (a) Male; (b) Female

(After Kuth)

SPECIES AND LIFE HISTORIES

Six species of lice are recognised as affecting cattle in Australia but only four of these have been recorded in this State. These are:—

The Short-Nosed Sucking Louse, or Blue Louse.

(Haematopinus eurystermus)

This species occurs chiefly in grown cattle, particularly the beef breeds, and is generally found in clusters on top of the head, around the eyes and nose, on the neck, brisket, withers, rump, tail, inside the thighs, scrotum, sheath, and udder. It is very common and widely distributed in Australia and has a greyish body colour with a brownish head which is short and blunt. The eggs hatch in from 11 to 18 days and in about another 12 days the lice are sexually mature and the females commence to lay eggs. Males may live up to 10 days and females up to 16 days. During her lifetime the female may lay 35 to 50 eggs.

The Long-Nosed Sucking Louse.

(Linognathus vituli)

This is undoubtedly the most common and important species in Western Australia and occurs frequently in the South-West portion of this State, especially in young animals. It was this parasite, coupled with severe internal worm infestation, which was responsible for the serious losses encountered in calves and yearlings a few years ago. Like the Short

Fig. 2.—The Long-Nosed Sucking Louse
(After Kuth)

Nosed species it is found in clusters and has much the same distribution on the body. It has a dark grey body with an almost black head. The head is twice as long as it is broad and the parasite is smaller and more slender than the Short-Nosed Sucking Louse. The eggs hatch in from 10 to 14 days and the lice mature 11 days later.

The Biting Louse of Cattle.

(Damalinia bovis)

This species was recorded recently for the first time in Western Australia at Pinjarra and at Geraldton. It is reddish-brown in colour and occurs chiefly in dairy herds and stabled cattle. It is found usually on the top of the head, neck, shoulders, back and rump. Biting lice may be found on cattle of all ages and when numerous are capable of causing considerable annoyance and irritation. The eggs hatch in about 9 days and the lice reach maturity about 14 days later.

The Tubercle-Bearing Louse, or Little Blue Sucking Louse.

(Solenoptes capillatus)

This is one of the smallest of the cattle sucking lice and was first reported in Western Australia in 1932 from Herne Hill. More recently a young bull from Wooroloo area was found to be heavily infested with this parasite.

The Tubercle-Bearing Louse occurs in conspicuous clusters on the head and neck and its eggs hatch in from 10 to 13 days.

TRANSMISSION

Lice are usually spread from animal to animal by contact, and it has been noticed that adult lice instinctively move outward along the hair when a lousy animal rubs against another beast. Infestations are seldom spread by eggs and lice on detached hairs as under these conditions both eggs and parasites seldom live for more than a few days.

SEASONAL PREVALENCE

Lice infestation may occur practically at any season of the year but it is only under certain conditions that the parasites assume serious proportions. Heaviest infestations are found during winter but large lice populations may occur on stalled cattle during summer.

It has been suggested that the temperature of the skin surface is a controlling factor. In the case of the cattle biting lice *(Damalinia bovis)* for example the upper limits for population maintenance are between 90° F. and 100° F. When

Fig. 3.—The Biting Louse of Cattle
(After Helmsing)

animals are exposed to bright sunlight during the summer, the skin temperature may rise to 125° F. which soon results in the death of the parasites. Where cattle are stall-fed, in lower temperatures, heavy infestations may occur during summer months.

Fig. 4.—The Tubercle-Bearing Louse or Little Blue Sucking Louse

Other factors which may influence lice populations are the state of nutrition of the host animal, the condition of the skin and coat, and the intensity of light. The last-named factor would hardly apply in Australia where there are many bright sunny days during the winter time when lice are apt to be most abundant on pastured cattle.

SYMPTOMS

In heavily lice-infested animals which are constantly rubbing and scratching there is usually a marked loss of hair and the coat becomes rough and shaggy. In very bad cases the hairs of the coat become matted. The skin becomes dry and scaly so that large scabs or crusts may form, resembling the lesions of mange.

Lousy animals are restless, do not feed well and their reduced condition may make them susceptible to other diseases.

Lice infestation causes lower milk production in dairy cattle and leads to retarded weight gains particularly in young stock. In the case of calves, lousiness leads to much licking of the coat, and since the hair is loose, hairballs form readily and frequently lead to internal disorders.

The constant sucking of blood and tissue fluids by sucking species of lice can lead to severe anaemia, and deaths from this cause may result when infestations are particularly heavy. Under the conditions experienced in the South-West of this State the lice populations commence to build in early winter when the pastures are low in nutritional value and when young cattle in particular find it difficult to obtain sufficient nourishment to keep them in a healthy condition.

TREATMENT AND CONTROL

A knowledge of the life history of the parasite is helpful in the application of control measures. The female lice lay eggs and attach them to the hairs of the host. These hatch in 10 to 12 days and the newly hatched lice reach sexual maturity after a further 16 to 18 days and commence to lay eggs. The life cycle from egg to egg is thus about 28 days.

Cattle lice may be eradicated by spraying either with dieldrin or B.H.C. (Gammexane) applied at a concentration of 0.05 per cent. These insecticides are readily available on the market and they should be mixed and used according to the directions of the manufacturer.

When used at the recommended strength both dieldrin and B.H.C. are safe and effective insecticides, but they have been reported on odd occasions to have produced toxic effects in young and weak animals. It is therefore safer to treat young calves and cattle in low condition with 0.5 per cent D.D.T.

A single treatment will provide a good measure of control but two treatments separated by an interval of 14 days are essential for complete eradication.

Lice eggs are seldom destroyed by spraying fluids and the second application ensures that young lice which have hatched after the first treatment are destroyed before they commence to lay.

It is essential also that all cattle on the property should be treated at the same time since any that are left untreated may readily re-infest the herd.

Lice populations decline in the summer, but increase and reach serious proportions in the winter, and treatment in the late autumn or early winter is necessary if this build-up is to be prevented.

Small herds may be treated with a knapsack spray or better still with a fire-fighting unit fitted with a suitable nozzle,

but care must be taken to ensure that the insecticide is thoroughly applied and each animal is completely saturated.

For the treatment of large herds, power operated sprays are a necessity. A sheep shower with the walls of the spraying enclosure strengthened and re-inforced will be found very useful, but an appliance such as the water-wall spray race which is specially designed for cattle and enables large numbers to be treated rapidly and efficiently, is much more satisfactory.

Notes on Submitting Diseased Poultry for Examination

THE majority of the poultry specimens received at the Department of Agriculture's Animal Health and Nutrition Laboratories arrive in a condition which makes it impossible for the Veterinary Pathologist to make an accurate diagnosis, and the Department requests farmers to co-operate as suggested hereunder. Unless they do so, little satisfaction is likely to be derived by either the Pathologist or the farmers concerned.

1. In the case of chicks up to eight weeks of age, not less than six birds should be supplied for post-mortem examination. In no case, regardless of age should fewer than two birds be supplied, and larger numbers are preferred. It will be realised that a single bird is seldom fully representative of a disease condition or other problem affecting a whole flock.

2. Birds supplied for diagnosis must be living. Dead birds decompose rapidly and often fail to reveal the cause of the deaths. Also, it is impossible to isolate viruses and extremely difficult to isolate bacterial agents from decomposed specimens.

3. Birds chosen for diagnostic purposes must not be on the point of death. The owner should pick birds just beginning to develop **typical** signs of the disease outbreak and also two or three birds from the affected flock which are still apparently healthy. Very sick birds will probably die before reaching the pathologist.

4. Living specimens should be placed in suitable containers such as ventilated cartons just before being forwarded and should be transported to the Animal Health Laboratories in the shortest possible time.

5. A **full** and **adequate** description of the disease problem must accompany the birds. Furthermore, a detailed outline of flock management, housing, introduction of new birds, feeding, past difficulties, etc., should be included.

6. All diseased birds should be forwarded to the Veterinary Pathologist, Animal Health and Nutrition Laboratory, Department of Agriculture, Smyth Road, Nedlands.

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THE PRUNING OF FRUIT TREES

By H. R. POWELL, B.Sc. (Agric.), Superintendent of Horticulture

PART 3 (contd.)—DECIDUOUS FRUIT TREES (PEARS)

THE commercial varieties of pears grown in Western Australia consist of Bartletts (W.B.C.), Packhams, Kieffers, Josephine, Comice, Beurre Bosc, and Winter Nelis. The annual production of pears (approximating to 130,000 bushels) is relatively small compared with that of other fruits.

The general principles of framework pruning were discussed in Part 2 of this series of articles (May-June, 1953) and this applies to pear trees as well. However, special attention must be paid to spreading the trees, otherwise they will be too narrow (see Fig. 35). If they are neglected they resume vertical growth as can be seen in Fig. 3. Illustrations Figs. 5, 100, 101 show the excellent results which can be obtained by training the naturally strong erect growth of these trees into well-spread and balanced orchard trees.

The usual methods of spreading the leaders on young trees are by spreaders (Figs. 14, 16 and 19) and pruning to outside laterals on the more upright shoots (Fig. 19). Spreading can also be obtained

Fig. 100.—An example of excellent framework pruning. The tree is a B. Bosc, 27 years old, grown on the orchard of Mr. W. De Pledge, Kendenup. The fruiting wood, laterals and spurs are evenly distributed

Fig. 101.—A row of Comice pears, 26 years old on an orchard in the Mt. Barker district. Although unpruned for the last few years, the trees show the results of previous sound framework pruning.

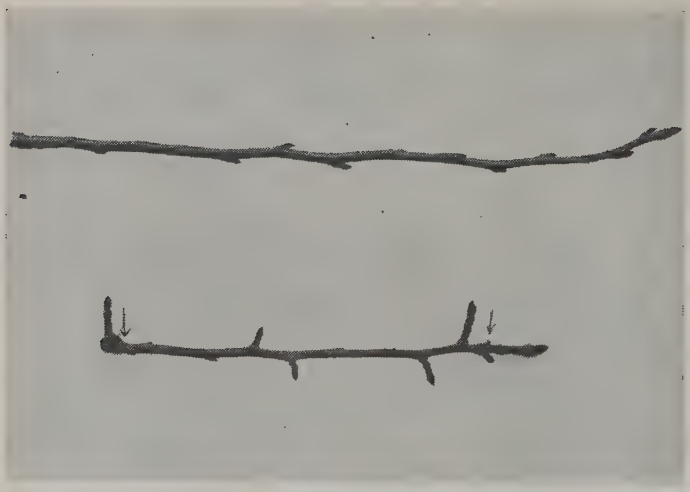

Fig. 102. — Laterals — the uppermost is a one-year lateral — variety Bartlett. The plump terminal and side buds are fruit buds. The smaller buds at the base are leaf buds. These laterals where not too numerous or badly placed, should be retained untipped. This applies particularly to the warmer districts. The one beneath is a **two-year-old lateral** of the same variety. Spurs have formed from side buds and from the terminal bud—marked with arrows. These laterals are valuable fruit-producers, particularly in the colder districts. At this stage no pruning treatment should be necessary. However, when it is necessary to reduce the expected crop, the lateral could be shortened back to the **junction of one-year** and two-year wood, or further back to a fruit spur if necessary

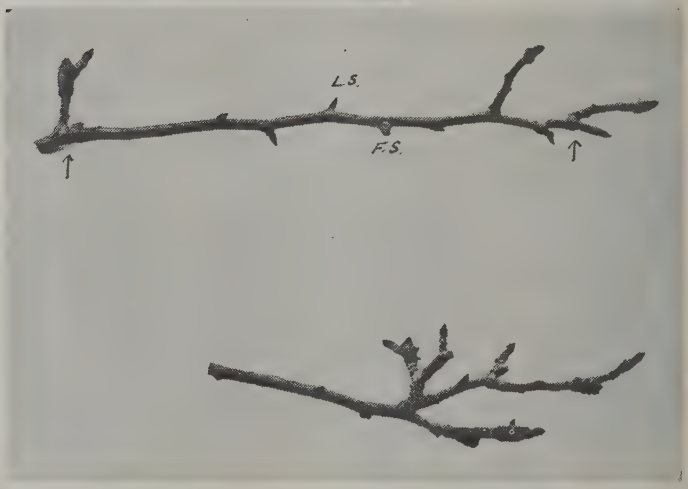

Fig. 103. — The topmost lateral (Bartlett) shows three years growth. The short basal piece is three years old and it will be noted that the spur set fruit the previous season and continued its growth by a new spur on the right.
The middle portion is two years old; one fruit spur and leaf spurs which are thin and pointed have developed; of the topmost buds, the terminal bud in all probability flowered and as a result vegetative growth was continued by two somewhat elongated spur like shoots, the topmost ending in a fruit bud; a similar shoot emerged from a leafbud just behind the terminal extension
No pruning treatment is suggested unless fresh lateral growth is required to replace weakened fruiting wood. If this is necessary the lateral could be shortened back to the fruit spur on the two-year wood, or to the basal spur as the case may be. The lower example, also Bartlett, depicts the onset of spur ramification. As each fruit spur flowers, its vegetative growth is continued by one or two similar growths, which can behave likewise the following year. In time a much branched system can be created. Spur ramification usually denotes decreasing vigour and should be closely watched. See Figs. 94 and 114

by leaving the growth in the centre of the trees for several seasons, provided it is well controlled, by being shortened back each winter below the height of the outer branches. When the desired results have been obtained the centre portion can be removed. However, care would be necessary during the following growing season to rub off all growth from below the pruning cut which could develop into strong water-shoots.

Provided sufficient spread of the leaders can be obtained, pear trees respond particularly well to the retention of untipped leaders. With strong growing trees this is illustrated by Fig. 29. Occasionally the trees may make uneven growth and this can often be controlled by pruning back the stronger leaders, and leaving the weaker ones untipped (see Figs. 12, 14, 71).

Fig. 104.—The topmost illustration — variety Packham—shows the effect of shortening back each annual extension — this has been done over the last three years. It is considered that better results could be obtained by leaving the original lateral growth untipped and subsequent shortening back when necessary. No pruning is necessary now but shortening back will probably be necessary next winter
The lower example—Packham—shows the beginning of spur ramification. In this instance the system could be reduced by at least the lower third. See Figs. 94 and 114

The number of leaders retained on a mature pear tree varies, usually between 12 and 18, but with more erect growth the number would be less.

THE ANNUAL WOOD GROWTH

The annual wood growth consists of water-shoots, wood-shoots, laterals, fruit spurs, leaf spurs, fruit twigs and leaf twigs. A general description of these parts was given in Part 1, and the treatment of wood-shoots and water-shoots was outlined in Part 2.

The more detailed description given in the section dealing with apples can also be applied to pears. The characteristics of growth and fruiting of both types of trees are similar, the main difference being that pear trees being more vigorous make larger trees and thus tend to be treated by growers in extremes, either too lightly (Fig. 103), or too severely (Fig. 108).

TREATMENT OF THE ANNUAL WOOD

The general recommendations made for the treatment of the annual wood of apples also apply to pears. Due allowance

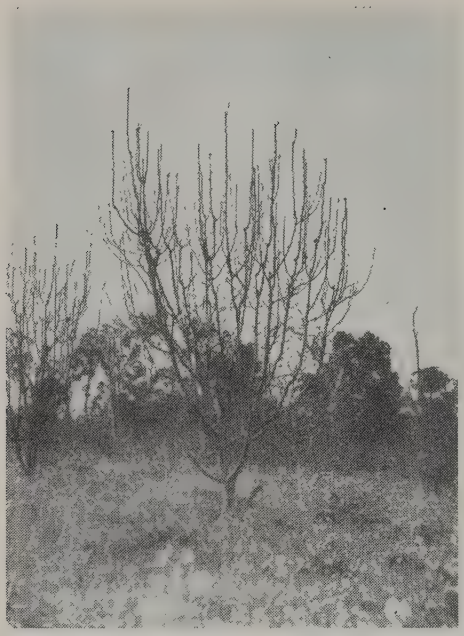

Fig. 105.—A six-year somewhat stunted Packham carrying too many leaders. The crowding in the centre of the tree has however, caused spreading of the outside branches

Fig. 106.—The same tree pruned. The effect has been to reduce the number of leaders, and by concentrating on suitable outside branches a reasonably well spread tree has been obtained

must be made for the more vigorous growth of pear trees and great care should be taken not to prune too severely, otherwise the annual growth will consist of strong wood-shoots useless for immediate fruit production.

On strong-growing trees it is preferable to leave the laterals long, particularly those which are growing in a horizontal or downward position. Lateral growth is often strong, particularly on grafted trees, or on trees which have been pruned too severely (Fig. 107). In these instances they can be kept up to approximately 3 ft. in length. On occasions the more vertical ones can be tied down to reduce the possibility of further strong growth.

An advantage in leaving the laterals untipped is that the terminal bud is often a fruit bud; should fruit develop from these buds, as frequently happens, the weight of the fruit will force the fruitful laterals downwards and thus reduce the possibility of further strong growth.

The treatment of laterals generally is similar to apples. The shortening back of two-year-old laterals should be a gradual process (Figs. 102 and 103). Should it be too severe, strong vegetative growth may eventuate and the previous balance will be lost.

In the warmer climate of the Hills districts, the crop of some varieties of pears, particularly Bartletts, is carried mainly by the terminal buds of one-year laterals, and in the colder areas of the South West and Great Southern, the crop can be obtained from the spurs on the older laterals. However, even in the colder districts the terminal buds on one-year laterals should be conserved, particularly in years following heavy crops, as they can often change a very light crop from the spurs to a medium crop from the laterals. Josephine is a variety which can well be lateral pruned under the above circumstances.

With age, growth diminishes and unless stimulated by pruning, fruit and leaf spurs tend to ramify and the tree becomes more inclined to biennial bearing (Fig. 113).

Fig. 107.—Six-year Packham grafts on Josephine. Due mainly no doubt initially to the over severe heading back of the Josephine when grafted, difficulty has been experienced in bringing the new tree under control. Hard pruning has added to the confusion

Fig. 108.—The same tree purposely overpruned to show the treatment of long laterals. Those in a near horizontal position have been retained unpruned, whilst others have been tied down
A more sympathetic treatment would have included the definition of the leading shoots leaving them untipped and thinning out and shortening back the the overcrowded lateral growth particularly in the centre of the tree

Fig. 109.—An unpruned Packham leader of a mature tree. In the previous pruning, the stronger laterals were shortened back and a few of the weaker and more horizontal ones were left untipped

Fig. 110.—The same leader pruned. It will be noticed that the better placed terminal wood growth has been selected as the leader extension and as the growth is not vigorous, it has been left untipped. The uppermost laterals have been shortened back to prevent cropping, which through sheer weight could cause damage to the weakest part of the leader. The stronger vertical laterals have been shortened back. At the same time the two-year laterals have been shortened back to suitable sub-laterals or to fruit spurs. See Figs. 102, 103 and 104

Fig. 111.—A portion of a Bartlett leader, showing the system used by a Hills grower to obtain satisfactory crops through the terminal buds of one-year laterals. The method used is to shorten back each lateral growth. The result from a cropping point of view has been satisfactory, but the older parts of the trees have become overcrowded with spindly growths

Fig. 112.—The portion of the Bartlett leader shown in Fig. 111, pruned. In this example, an attempt has been made to regenerate new growth closer to the leader, and some productiveness for the next season has been lost

Where possible, one-year laterals have been retained untipped, and in others cuts have been made to well developed spurs on the older wood—generally in the Hills districts most of the crop is carried by the one-year laterals

Fig. 113. — Portion of Comice, which has not been pruned for four years. Total growth of the tree has increased, by the cessation of pruning, but the maze of uncontrolled growth has weakened the shaded inner branches and spurs and made spraying for scab control more difficult

Fig. 114.—The same portion of a Comice leader shown in Fig. 113, pruned to show the spacing of laterals, and spur reduction

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PULLORUM-TESTED POULTRY FLOCKS 1959

EARLY in 1955, an amendment to the Stock Diseases Act made blood-testing compulsory for all commercial breeding and hatchery flocks of poultry, and it was required that the incidence of infection, as determined by the last test prior to the commencement of hatching, must be less than two per cent.

For the seven years 1948-54 when blood-testing was on a voluntary basis the average percentages of reactors were 5.43; 5.65; 5.95; 3.37; 2.53; 1.36 and 0.77 respectively.

The 1958 tests showed an average percentage of only 0.18 per cent. of reactors —the lowest figure to be recorded—and this was again achieved in the current season. Only 226 reactors were found in a total of 122,369 birds tested, and just over half the 69 flocks tested contained no reactors.

The breeds of poultry in the various flocks are indicated by the following abbreviations:—

Australorp, A; White Leghorn, WL; First Cross, XB; Rhode Island Red, RIR; Light Sussex, LS; Black Leghorn, BL; Legbar, LB; Cambar, CB; Plymouth Rock, PR; Campine, C; New Hampshire, NH.

Name and Address	Breeds	No. of of Birds Tested	Percentage of Reactors
Adams, W. T., Bullsbrook	WL	4,211	0·35
Anderson, P., King Edward Rd., Osborne Park	A ; XB	1,771	0·28
Angel, L., Mount Helena	A ; WL	1,088	....
Avard, A., Belgravia St., Belmont	XB	1,698	....
Barker, G., Widgee Rd., Morley Park	A ; WL ; XB	3,369	0·29
Barnett, T., Cowaramup	A	405	....
Bell, C. J., Grand Promenade, Morley Park	A ; XB	2,680	0·37
Bell, N. A., Abernethy Rd., Cloverdale	A ; WL ; XB ; RIR	4,667	0·53
Carter, R. J. and N. H., Eva St., Maddington	WL	1,459	....
Catherall, W. H. and G. E. F., Taylor St., Maida Vale	A	170	....
Chadwick, F., Narrogin	A ; WL	1,060	0·47
Chalmer, H. and D., Acanthus Rd., Riverton	WL	1,819	....
Chalmer, F. E., Acanthus Rd, Riverton	WL	1,761	0·06
Charlton, A., Spring Rd., Kenwick	A ; WL ; XB	3,478	....
Cole, H., Division St., Welshpool	A	1,251	0·16
Cook, W. A., Welshpool Rd., Welshpool	WL ; A	3,169	....
Conlon, T., Troy St., Bassendean	A	1,090	....
Dabelstein, E. T., Ypres Rd, Kelmscott	A	1,836	0·10
Dadley, M. H., Rockingham Rd, South Coogee	WL	1,598	0·12
Davey, A. E. and I, Eleventh Rd, Armadale	A ; WL	2,336	0·13
Davey, R. W. and C. L., Seventh Rd, Armdale	A ; WL	1,506	1·19
Davey, F., Seventh Rd, Armadale	A ; WL	1,048	0·19
Davey, R. A., Mundijong	A ; WL ; RIR; LS ; BL ; LB ; CB ; PR ; C	3,249	0·18
Doyle, A. E. and A. M., King Rd, Beechboro	A ; XB	2,426	0·24
Fawkes, A., Wyatt Rd, Bayswater	A ; WL	3,078	0·42
Fenton, J., North Lake Rd, Melville	A ; WL ; RIR	3,641	0·08
Gardiner, C., Division St., Welshpool	A ; WL ; RIR	2,411	0·17
Gates, A. S., King Edward Rd, Osborne Park	A ; XB	2,220	0·13
Gregory, A., Victoria Rd, Kenwick	A ; XB	1,574	....
Hampton, A., Scott St., Kewdale	A ; WL ; RIR	10,501	....
Hall, W. G., South Rd, Melville	A	1,988	....
Hedges, J., President St., Kewdale	A	1,543	0·77
Heggie, L., Wanneroo Rd, Wanneroo	A	1,728	0·58
Hickson, R., Amherst St., Swan View	A ; WL	770	....
Hill, R., Widgee Rd, Morley Park	A ; WL	1,995	....
Huggall, T., Maida Vale Rd, Maida Vale	A	857	....
Hunter Bros., Oats St., Kewdale	A	822	....
Keene, K., Great Eastern Highway, Redcliffe	A ; NH	175	....
Kendall, L., Swan St., East Guildford	A ; RIR	218	....
Martin, V., Station St., Gosnells	A	632	....
Milburn, R., Forrestfield	WL	136	....
Miles, R., Wanneroo Rd, Wanneroo	A ; WL	1,973	....
Muresk Agricultural College, Muresk	A ; WL	186	....
McGregor, E. M., Uranium St., Kewdale	A	1,613	....
McGrath, W., May St., Kewdale	A	270	....
McIntyre, B., Merredin	A ; WL ; RIR ; XB	1,013	....
McAuliffe, K., Katanning	A	132	....
Oliver, R. E., Welshpool Rd, Welshpool	A ; WL	1,425	....
Parin, A., 11 Mile, Wanneroo	A	1,678	0·06
Porter, S. L., Narrogin	A ; WL ; RIR ; LS	1,977	0·71
Price, E. E., Macedonia St., Naval Base	WL	2,180	....
Preston, J., West Swan Rd, West Swan	A	252	....
Pymm, G., Wanneroo Rd, Wanneroo	A	1,405	....
Reid, J., President St., Kewdale	A ; WL ; RIR	998	0·40
Roberts, S. G., Cohn St., Carlisle	A ; WL	2,322	0·55
Sears, G., Wanneroo Rd, Wanneroo	A	1,950	0·10
Stevens, J. H., Swan St., Guildford	A ; WL ; RIR	830	1·32
Straw, F. and D. M., Adelaide St., Maida Vale	A ; XB	1,839	0·27
Smith, J. T., Llonel Rd, Darlington	A	1,848	0·16
Tyler, A., Beechboro Rd, Bayswater	A	1,472	....
Upsom & Son, Pemberton	A ; WL	1,127	....
Wear, R., Kew St., Kewdale	A	106	....
Wilshushen, T., Wharf St., Queens Park	A ; WL ; XB	1,537	....
Webb, G., Priory Rd, Maida Vale	RIR	48	....
Whittaker, G. E., Yale Rd, Kenwick	A ; WL	3,968	0·17
Woodard, L., George St., Queens Park	A ; WL	2,221	....
Woodard, H., Hughes St., Canning Vale	A ; WL	2,168	....
Wilson, H., Kooyong Rd, Belmont	A ; WL	787	0·25
Yates, A., Fatham St., Cloverdale	A ; WL	1,600	0·44
Total	....	122,369	0·18

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MASTITIS in CATTLE

By P. B. LEWIS, B.V.Sc., Veterinary Surgeon

MASTITIS (sometimes called mammitis) is a term used to denote inflammation of the mammary gland. It is a common complaint among dairy cattle and this is not surprising when one considers the enormous development of this gland, the delicacy and complexity of its structure, and the fact that it is placed in a position where it is subjected to pressure from the cow's legs and liable to injury from the horns of her herd-mates and other outside sources.

It has often been said that the modern dairy cow's udder is a man-made organ. When the ancestors of our cows roamed the world in a wild state, their udders were small inconspicuous vessels which supplied sufficient milk to nourish their calves, and no more. The calves suckled frequently and possibly the udders seldom carried more than a pint or two of milk.

Today the udder has become a huge mass of highly sensitive tissues secreting vast quantities of milk—more than 10 gallons daily in many instances. The udder has four openings to the contaminated air of the cowshed and in the process of milking there is always a risk of bacterial infection being transferred from udder to udder in the herd.

IMPORTANCE

Mastitis, tuberculosis, brucellosis and Johne's disease are usually referred to as the "Big Four" of cattle ailments throughout the world.

As a result of the high incidence of mastitis in all dairying countries, the annual financial losses from this disease alone are enormous, and add greatly to the production cost of milk and milk products.

Deaths of cattle may occur from blood poisoning following severe mastitis infection; milk production may be substantially lowered by the permanent or temporary "loss of a quarter" in high-producing animals; milk and milk products may be down-graded due to high bacterial content and, in addition, the dairy farmer is compelled to spend time and money in the prevention and control of the disease.

Added to this are the expenses involved in increased culling and last, but not least, is the danger to human health resulting from milk-borne bacteria in countries where pasteurisation is not practised.

CAUSE

Mastitis is an infectious disease and may be caused by any one of a number of different bacteria or a combination of several of them.

As previously indicated, the udder is a particularly susceptible organ because of its size and construction. As the cow walks, a large distended udder is constantly subjected to pressure and pummelling by the hind legs. Kicks, bruises and horn-prods can cause major or minor injuries and badly-adjusted or badly-operated milking machines can damage the tissues—all creating ideal conditions for the rapid growth and multiplication of bacteria, many of which find milk a highly suitable medium for propagation.

Infected milking machine cups, wash-water or wash-cloths, or the hands of the operator can convey the bacteria from one cow to another and the impossibility of keeping cowsheds and yards bacteriologically clean offers countless opportunities for infection to occur, particularly when injuries create suitable conditions for their entry into the tissues.

TYPES

Most cases of mastitis may be loosely grouped under these three main headings:—

1. Hyper-acute.

This type of mastitis differs from the other two in that the cow appears generally sick, being depressed, feverish and with a total loss of appetite. The udder is hot and painful to the touch and there may be a small secretion of blood-stained fluid. Some differences occur according to the type of bacteria responsible.

(a) *Staphylococcal or Gangrenous Mastitis* usually occurs within the first week of calving. The animal frequently goes down and the trouble may be mistaken for milk fever. The affected teat and the lower part of the quarter become purple or black and a claret-coloured fluid is secreted. If left untreated, a large proportion of the affected animals will die. In those which survive, the affected quarter or quarters may slough or drop off.

(b) *Streptococcal Mastitis* is similar except that there is no gangrene or death of the quarter. The secretion is purulent (containing pus) and may be thick and custard-like. The quarter is usually permanently affected and may be left completely "blind."

Other forms of hyper-acute mastitis are encountered resulting from infection with various bacteria, but these are less common.

While hyper-acute mastitis does not usually respond well to udder injections of penicillin or other antibiotics, these should be tried. In addition, systemic treatment with antibiotics such as sulphamezathene should be carried out. These injections require the attention of a qualified veterinarian, but where such services are not available, sulphamezathene injections, as used in the treatment of "foul foot," may be tried.

2. Acute.

This type occurs suddenly without affecting the general health of the animal. The quarter is hot, swollen, hard and painful. The milk from the affected quarter will be found to contain flakes or clots. These are most noticeable in the first few ounces of milk drawn from the teats, and the use of a strip cup in which the first milk is passed through fine wire gauze will assist in detecting any clots or flakes in the early stages of the disease.

Later, the milk is replaced by a yellowish-brown watery fluid containing flakes and clots. In some cases, this fluid assumes a custard-like consistency.

The affected quarter may respond to treatment and recover fully, but complete or partial loss of the quarter commonly results.

3. Chronic.

Clots occur periodically in the milk and there is a gradual loss of function in the quarter which usually becomes increasingly hard and fibrous after each attack. The milk appears fairly normal except for the intermittent appearance of clots or flakes. In some instances, the quarter ceases to secrete milk without becoming hard and fibrous merely resembling a quarter which has been completely milked out.

The chronic or sub-acute cases of mastitis are the type most commonly encountered and are responsible for most of the losses resulting from this disease.

TREATMENT

Penicillin, either alone or in combination with other drugs, is still the most commonly-used preparation for the treatment of mastitis by udder injection. It is sold in tubes with special nozzles for direct injection into the teat canal.

The recommendations below are based on those given by the Commonwealth Serum Laboratories. If other antibiotics are used they should be used according to the manufacturer's instructions.

For streptococcal mastitis give three doses, each of 25,000 units (actually sold as larger amount to allow for wastage), allowing a 24-hour interval between each dose; or two doses, each of 100,000 units allowing a 72-hour interval between.

For staphylococcal mastitis give three doses, each of 100,000 units with a 24-hour interval between each dose.

Technique.

(a) Wash the udder thoroughly with warm soapy water, or with warm hypochlorite solution (1½ oz. or three tablespoons of commercial sodium hypochlorite

solution to one gallon of warm water). Wring out the wash cloth and dry the udder.

(b) Milk out the infected quarter into a bucket containing a disinfectant.

(c) Swab the teat opening with a clean piese of cotton wool saturated with methlyated spirit. (Allow the spirit to evaporate before inserting tube.)

(d) With clean hands remove the cap from the tube without touching the nozzle.

(e) Hold the end of the teat firmly between the finger and thumb and insert the nozzle of the tube gently into the teat orifice. Squeeze in the whole of the tube contents. The tube must be squeezed from the base towards the nozzle to eject all the contents. Discard the empty tube. Holding the end of the teat firmly to prevent escape of the penicillin suspension, massage the teat upward several times to distribute the penicillin suspension into the milk cistern.

(f) Repeat this treatment after each afternoon milking until the required number of doses have been given.

PENICILLIN AND CHEESE MANUFACTURE

The use of penicillin affects the milk used for cheese manufacture, due to its action against the lactic acid forming bacteria necessary in the initial cheese-making process.

For 24 hours after dosing with 25,000 units of penicillin in a quarter, the penicillin level of the milk is high enough to affect cheese manufacture if only one quarter in 50 has been treated. If the dose rate has been higher then the levels will remain higher for longer periods.

The safe times for sending milk to cheese factories, after treatment, for cows in full lactation, are:—

After treatment with 25,000 units—
36 hours

After treatment with 100,000 units—
72 hours

After treatment with 300,000 units—
9-10 days

PREVENTION

The main aims in preventing mastitis are to reduce the number of mastitis-causing organisms in the milking-sheds and yards; to prevent as far as possible, all forms of udder injury which offer an easy entrance for the germs, and to reduce the chances of the organisms being conveyed from one cow to another.

Hygiene.

Careful attention to hygiene—clean sheds and yards—and disinfection of teat cups, wash cloths, and the milker's hands will help.

The use of hypochlorite solution (1½ oz. commercial hypochlorite to a gallon of water) is recommended, but this solution uses its effectiveness rapidly if the water is contaminated with organic matter such as milk or manure. It should be changed after each 12 to 14 cows.

The teats should be washed with warm soapy water, excess moisture removed with a wrung-out cloth, and disinfection carried out with the hypochlorite solution.

Incidentally, a new disinfectant marketed Hibitane udder wash, appears to hold promise as it is non-irritant and not affected by organic matter.

Teat cups should also be sterilised and placed in position as soon as possible after sterilising the teats. After milking each cow, the cups must be cleaned by plunging them into a bucket of warm water containing one heaped dessertspoonful of washing soda to the gallon. Raise and lower them a few times to wash off the milk, then shake off the water and immerse in hypochlorite solution for 10 to 20 seconds, before putting them on the next cow.

Preventing Udder Injuries.

Cows with pendulous udders are more liable to udder injuries than those with well-shaped vessels that are well attached and extend well forward and upward. Where possible, breed from animals with shapely udders.

Dehorning—preferably during calf-hood —will cut down injuries from horn-prods, and attention to fences and the elimination of barbed wire will help.

Good milking machine maintenance and correct usage of the machines will prevent many injuries. Excessive vacuum pressure causes redness and prominence of teat openings and small sores at the tips of the teats, and may result in painful warty growths.

Pulling off the cups without releasing the pressure has similar effects. Too rapid pulsations and leaving the cups in position too long allow the cups to crawl up the teats and cause injuries to the linings of the teat canals. Weights applied to the claws may be necessary for cows with small teats.

Faulty inflations may cause uneven milking and teat injury.

Preventing Disease Transmission.

Clean cloths, clean wash-water and clean hands will help to prevent this. Calves allowed to suck may transmit infection from quarter to quarter and from cow to cow. Calves and pregnant heifers should be segregated from the milking herd.

Hand-stripping after machine milking increases the chance of cow to cow infection.

Try to milk the first-calf heifers first, then the "clean" cows next, with "suspects" and cows known to be affected last of all.

Dispose of chronic cases—they are always a potential source of infection.

Clifford

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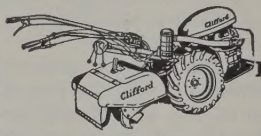

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